FACTORY

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MANAGEMENT AND MAINTENANCE

McGRAW-HILL PUBLICATION

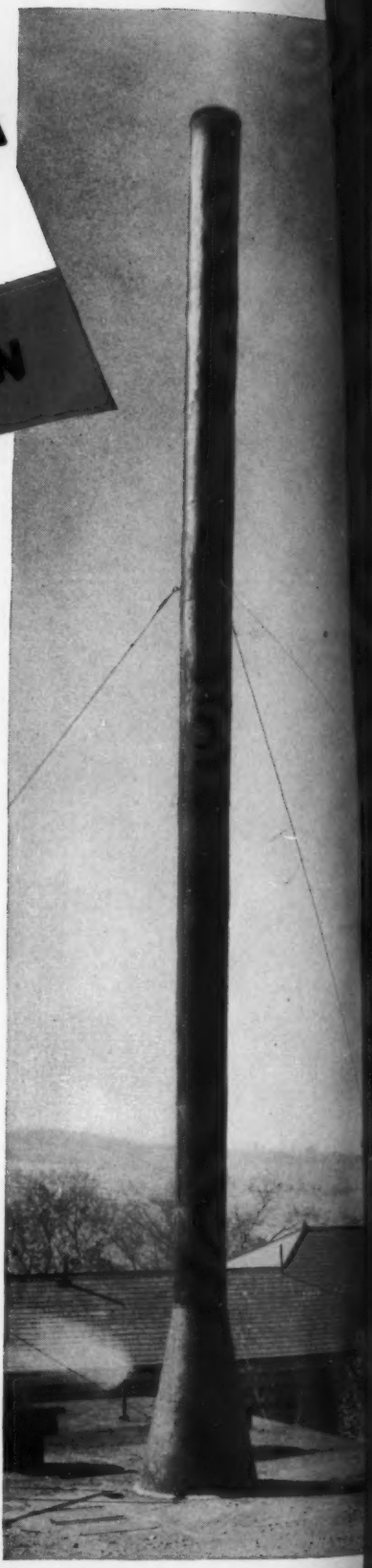
MARCH 1944

WHEN CONTRACTS END ... page 82

The Old Stack Died Too Soon . . .

so the new one is

BYERS WROUGHT IRON



When the power plant stack (made of ordinary material) at the Windber, Pa., Hospital failed after only 11 years of service, the engineer reviewed the possibility of getting greater durability before he wrote his specifications. The result is shown: the new stack is Byers Wrought Iron.

Any sound solution of a stack problem must start with the corrosive conditions involved. Carbon dioxide is produced whenever fuel is burned. If this gas is absorbed by moisture, it makes a highly destructive acid. If sulfur is present in the fuel, it too will form a corrosive acid. The condition may be aggravated at any time by increase of moisture in the flue gases, or by the cooling of the gases—through the use of economizers, or through intermittent operation which allows stack temperatures to drop below the dew point.

No ferrous metal is immune to this acid attack . . . but wrought iron is highly effective in resisting it. The matrix of high-purity iron is threaded with tiny fibers of glass-like silica slag. These fibers diffuse and disperse the corrosive attack, and so combat the pitting and rapid penetration that generally causes ordinary materials to fail. Further, the initial protective film is firmly anchored, and helps to shield the underlying metal from destruction.

You will find evidences of wrought iron's greater durability all over the country, in stacks that are still serving long after those made of low-first-cost materials have failed. Some of the most dramatic examples are provided by composite stacks. Take the one on a water company's plant, for instance. The top ring of the wrought iron stack required replacement after 30 years of uninterrupted service. An ordinary material was used in the replacement, *which failed after only 5 years.* The second replacement was naturally wrought iron, and it—and the original wrought iron in the lower part of the stack—are still on the job.

If you have a stack replacement problem, why not investigate and see whether wrought iron would make that new stack last longer. Our technical bulletin, "Wrought Iron in Flue Gas Conductors and Coal Handling Equipment" will give you some helpful information . . . and you can always call on our Engineering Service Department for specific service information.

A. M. Byers Company. Established 1864. Offices in Pittsburgh, Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

Corrosion costs you more than Wrought Iron

BYERS

GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE ALLOY STEELS • OPEN HEARTH ALLOY STEELS

CARBON STEEL TUBULAR PRODUCTS

Gas attack in an orange grove

Koroseal is a typical example of B. F. Goodrich development

POISON gas will kill the California red scale, an insect that attacks trees and fruit, ruining crops. But to kill it, the gas has to be held in some way around each tree. Canvas tents over individual trees were tried. But they weren't gas-tight. Coated fabrics were tried. But they couldn't stand the California sun. They cracked — and leaked.

University researchers asked B. F. Goodrich men for suggestions. B. F. Goodrich had Koroseal, the flexible material made from limestone, coke and salt which had been used as a waterproof fabric coating for shower curtains, baby pants, and other things. They knew it wouldn't harden and crack, that it wasn't affected by sunlight — or by air, water or most chemicals. A fumigation tent of Koroseal-coated cloth was made. After two years it's still in service, with no sign of cracking or checking. Gas leakage is practically eliminated, resulting in a better kill of the scale with only 1/3 the gas needed for the canvas tent.

Koroseal coatings on umbrellas, raincoats and such things won't get soft and sticky even if they're folded up when wet. As a coating on paper or as a transparent film it will have hundreds of new uses, and while Koroseal still can't be sold for home use, it's available for many essential industrial uses now. Reasonable amounts can be used for experiment, and we're glad to discuss possible future products, to help make plans or do development work. Write us if you have any problem for which a covering, coating or flexible material might give the answer. *The B. F. Goodrich Company, Industrial Products Division, Akron, Ohio.*

B.F. Goodrich

RUBBER *and* SYNTHETIC *products*

Koroseal—Reg. T.M.

Positive Identification of Ryerson Alloys

Confirms Quality . . . . . Prevents Shop Errors

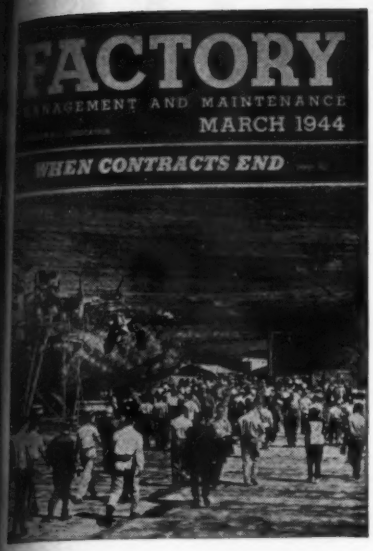
Each bar of alloy steel in Ryerson stock is painted on the end to indicate the type of alloy . . . and then stamped on the side near the end with the number of the heat from which the bar was rolled. Smaller size bars are bundled and tagged with similar identification.

This is important to you, because it offers an unmistakable means of verifying the alloy steel you receive from Ryerson. Also, both heat number and color marking are recorded on the Ryerson Alloy Steel Report that is furnished with each alloy shipment. The Report Sheet contains accurate data on the analysis, working temperatures and the heat treatment response for quenched and drawn 1, 2, 3 and 4 inch rounds of the steel you receive. This gives you reliable information for heat treatment that will produce the desired result.

This unique and valuable Ryerson alloy service is one of many reasons why it will pay you to concentrate your steel purchases with us.

Joseph T. Ryerson & Son, Inc., Plants at: Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

RYERSON



On this month's cover, change of shift at San Diego, Calif., plant of Consolidated Vultee Aircraft Corporation, whose employees are now said to exceed in number the city's entire pre-war population. Yard is covered with chicken-wire camouflage. Big patrol bomber is a Coronado. A Navy Department kodachrome.

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FACTORY

MANAGEMENT AND MAINTENANCE

MARCH · 1944

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PHOTO—BELL AIRCRAFT CORPORATION

Thread FOR SEWING STEEL

Everyday, welding rods in countless numbers, link patterned pieces of structural steel together to form mighty weapons for Victory. And every day war-time packaging safely delivers these vital rods to widely scattered scenes of construction. Never before has product packaging played so important a role.

Needless to say, each war-time packaging assignment is carefully studied by H & D Package Engineers, to gather from it every possible application that will make for better post-war packages; for surer, safer, undamaged deliveries.

Most of the new and better products of tomorrow will travel the rail, sea, sky and highways of the world in scientifically engineered corrugated boxes. So in planning your post-war packages—and *now* is the time—look to H & D for rugged, reliable corrugated boxes. Skilled H & D Package Engineers —authorities on packaging—know the correct formula for packages that protect and promote the product.

BUY WAR BONDS — KEEP THEM FOR FUTURE USE

Tells HOW to SHIP More Economically in Corrugated Boxes

Economies of time and materials have never been more vital than they are today. Effecting small economies all along the line result in savings of time and money. The H & D Little Packaging Library Booklet, "How to Ship More Economically in Corrugated Boxes," is a storehouse of useful packaging data compiled for those who do not have time to ferret out this information for themselves. You can get a copy of this booklet by writing The Hinde & Dauch Paper Company, Executive Offices, 4447 Decatur Street, Sandusky, Ohio.

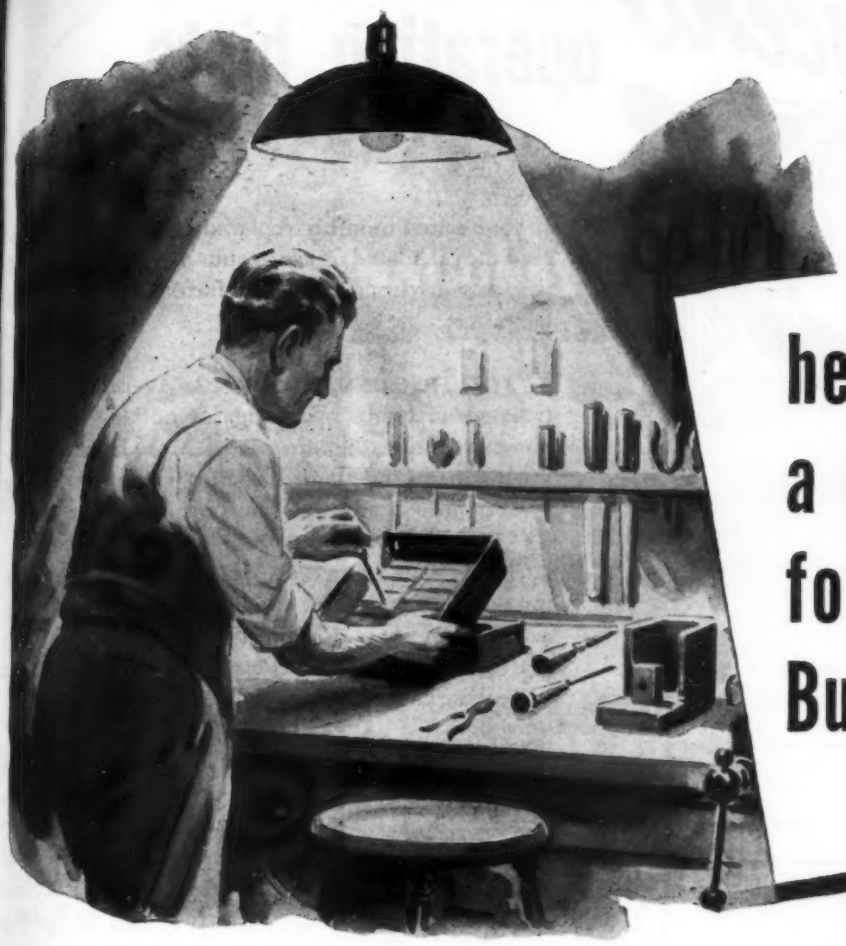
• • •

FACTORIES in Baltimore • Boston • Buffalo Chicago • Cleveland • Detroit • Gloucester, N. J. Hoboken • Kansas City • Lenoir, N. C. • Montreal Richmond • St. Louis • Sandusky, Ohio • Toronto

For postwar packaging . . better see H&D **HINDE & DAUCH**

AUTHORITY ON PACKAGING . . . CORRUGATED SHIPPING BOXES

a "GET-TOGETHER" at 1:30 A.M.



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helped speed a new assembly for the Navy's Bureau of Ships

A West Coast ship builder had appealed to GRAYBAR for a special type of relay enclosed in a watertight box, to meet Navy specifications. At the time, no manufacturer was set up to make this new assembly.

Graybar's separate contacts with a relay manufacturer, a maker of phenolic insulation and a builder of watertight boxes pointed the way. Individual parts were shipped to GRAYBAR from three sources.

Working after hours at a work bench, GRAYBAR'S local representatives made the "get-together" to complete the sample assembly. The very next morning, it was submitted for approval.

Official GR drawings by the Bureau of Ships established the assembly as acceptable. GRAYBAR was then able to arrange with a supplier for regular production to meet Navy orders.

IF YOU REQUIRE electrical sub-assemblies to be installed in combat equipment, GRAYBAR'S close liaison with several hundred competent manufacturers may mean equally fast action for you. If your need can't be met "out of the catalog," we can seek out someone to build it.

In addition, by getting electrical parts that go together in use from a single source, you save time, reduce paper-work and make it easier to schedule deliveries.

3502

MOBILIZED MATERIALS No. 15 of a series of actual examples of GRAYBAR service, providing electrical materials to be installed in ships, planes and other war products.

GraybaR

IN OVER 80 PRINCIPAL CITIES

Executive Offices: Graybar Bldg., New York 17, N.Y.

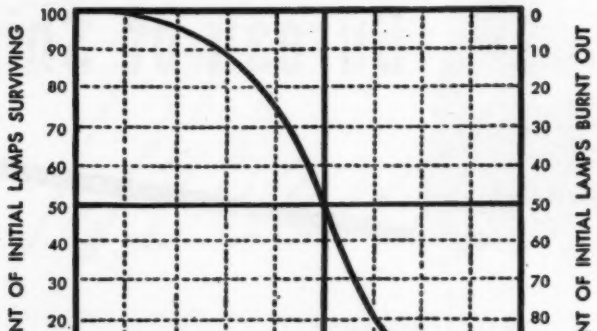
GRAYBAR 75 YEARS OF *Electrical Distribution*

Fluorescent operating hints

No. 2 of a series published by SYLVANIA for all users of fluorescent lighting

HOW TO GET FULL LAMP LIFE

Average rated life of good-quality fluorescent lamps is 2500 hours for the 40-watt size — 3000 hours for the 100-watt size. But the life of individual lamps may vary as the chart shows:



And actual operating conditions seldom are as favorable as controlled laboratory tests. Nevertheless, these average rated life figures will help you estimate how many lamps you will normally replace every month. Simply use 2500 or 3000 hours as indicated in this formula:

$$\text{Expected lamp renewals per month} = \frac{\text{No. of lamps} \times \text{average burning hours per month}}{\text{Rated average life of lamps in hours}}$$

If your actual monthly replacements consistently exceed the calculated figure in your own formula, it will pay you to check these five factors, which shorten lamp life:

1. TOO FREQUENT STARTING: Average rated life is based on lamps operating for not less than four hours every time they are started. More frequent starting dissipates the filament coating vital to fluorescent performance — and thus shortens lamp life.

2. DEFECTIVE STARTERS: Starters that are not working properly may cause the lamp to blink off and on, a condition that also shortens lamp life. Sylvania Starters cost only a few cents and should be replaced as necessary to protect your lamp investment.

3. VOLTAGE VARIATIONS: Fluorescent lamps are made to operate within specified *ranges* of voltage — for example, 110-125 volts. Variations within the specified voltage range do not seriously affect a lamp. But at voltages much below the range, starting becomes uncertain, and there is an excessive drain on electrode material — with a resultant toll on lamp life. Above the normal range, there is also a life-shortening effect. In addition, light output also is affected by voltages outside the normal range.

4. LOW TEMPERATURE: Fluorescent lamps are designed to operate most efficiently between 60 and 90 degrees Fahrenheit. If low temperatures are unavoidable, lamps may be protected with enclosed fixtures.

5. EXCESSIVE VIBRATION: This reduces lamp life and can often be prevented or minimized.

For Additional Maintenance Information

Send for this Free Booklet

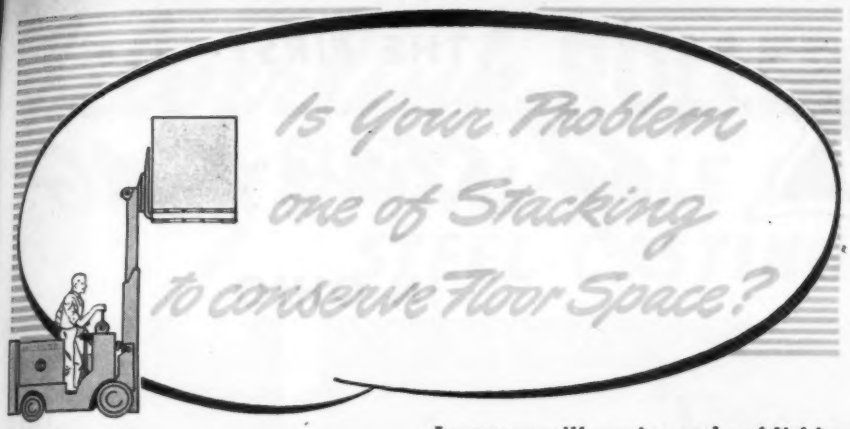
100,000 already distributed

SYLVANIA ELECTRIC PRODUCTS INC.

"Fluorescent at its Finest"

SALEM, MASSACHUSETTS

FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES, INCANDESCENT LAMPS, RADIO TUBES, CATHODE RAY TUBES, ELECTRONIC DEVICES



Hundreds of plants and warehouses have solved this and other material handling problems with Baker Trucks. So that you may profit from their experiences, a large part of our new catalog has been given over to actual installation stories. A few cases in point are listed below:

* * *

A leading industrial engineer was given the job of designing a large model warehouse for the world's largest paint manufacturer. Baker Trucks and Tractors were specified to bring about top efficiency in the sorting, storing and shipping of the more than 10,000 items handled in this warehouse. Illustration shows one of their fork trucks stacking pallet loads of drums three-high.

One of the problems confronting the planners of this warehouse was to find a way of getting at "buried" loads with a minimum of time and effort. This was solved by steel racks—permitting the fork truck to remove the lower pallet without disturbing cartons above.

A large west-coast processing plant saves thousands of dollars annually through the use of telescoping lift trucks. The Baker Fork Truck illustrated is tiering heavy pallet loads three- and four-high to conserve warehouse space.

In paper mills, print and publishing shops, Baker Trucks have more than doubled the value of warehouse space by permitting stacking to the ceiling. Reductions up to 80% in handling costs are reported. One publisher paid for his truck in 18 months' rental savings alone.

A Baker Material Handling Engineer was called in to make a survey of a large food warehouse. Upon his recommendations, a fork truck plus a conveyor system was installed. Operating costs were reduced from 6.68c to 4.98c per ton, a saving of 25.4%. Gross savings amounted to $153 per week or $7956 per year.

The problem of stacking steel sheets has been successfully met in steel mills and metal working plants through the use of heavy duty fork trucks, handling sheets on pallets—or equipped with rams for handling heavy rolls. A special roll-over attachment tiers rolls either vertically or horizontally.

If you have a material handling problem and are looking for the best answer, your nearest Baker Material Handling Engineer will gladly help you.

BAKER INDUSTRIAL TRUCK DIVISION *of The Baker-Raulang Company*

2178 West 25th Street • Cleveland, Ohio

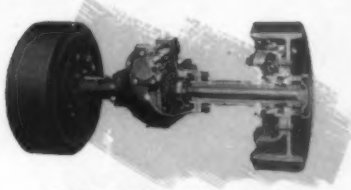
In Canada: Railway and Power Engineering Corporation, Ltd.

LOOK AT THESE BAKER CONSTRUCTION FEATURES BEFORE YOU BUY AN INDUSTRIAL TRUCK

Every part of every Baker Truck has been especially designed and developed for its specific function. Many Baker features are exclusive, others, pioneered by Baker are now standard in the industry.

BAKER NO-PLUG CONTROLLER

Promotes easy and safe operation, and protects truck life by compelling drivers to use acceleration steps. Accidental plugging from forward to reverse is prevented. Complete control is by one handle.



BAKER POWER AXLE

Exclusive Baker design—construction and materials designed for most efficient operation, low maintenance and long life. Hardened alloy steels are used in all vital parts. All bearings, axle shafts and universal joints are dust-protected.

BAKER-BUILT MOTORS

All motors are designed and built by Baker to give greatest efficiency for their specific function. Truck motors develop highest H. P. and contain more copper and iron than any others of the same size. Top efficiency is assured by ground fit between field ring and poles, heavy forged commutator bars and large brush surface. Brushes and armature shafts are easily accessible for adjustment or replacement.

WRITE FOR YOUR COPY

Plant and production managers, traffic managers, superintendents, purchasing agents and any others concerned with material handling will find the new Baker Catalog No. 52 a valuable reference.

THE FIRST 4 STAR FLAG IN OHIO

Monarch men and women accepted proudly the 4th Star for their Army-Navy "E" Flag, recently awarded them.

They have earned this recognition by their fidelity to the trust placed in them, when their first Navy "E" was awarded, November 11, 1941. They pledge "on time" deliveries of the lathes to which we are committed and of the other vital war material on which about 50% of our capacity is now engaged. They look forward to the day when their effort and our facilities (some of which are pictured here) may be put to full peacetime use, to help make more goods for more people, at lower cost.

THE MONARCH MACHINE TOOL COMPANY • SIDNEY, OHIO

MONARCH LATHES *Save Time*

Motion pictures of operations, studied in detail, show where even slight savings can be made in time or material.

Utilization of floor space to the best advantage is reflected in our increased production per square foot of plant area.

When tools were hard to get, we designed and built our own, such as this device to mill oil groove in carriage.

Final assembly floor, from which we shipped a mile of lathes a month during our greatest production periods.

Silverlink ROLLER CHAIN

PLAYS VITAL ROLE IN "COOKING" STEEL CASTINGS "TO ORDER"

Above: Silverlink roller chain (1¼" pitch RC-100), on cut tooth sprockets, serves to open and close the covers of 11 hardening and draw furnaces in the new TESCO heat treating plant. Power is supplied by a hydraulic drive. Silverlink roller chain (1½" pitch RC-120), also drives the transfer car to and from loading and unloading points, and the furnace cars to and from furnaces. Power for these cars is supplied through Link-Belt herringbone speed reducers and Friction Fighter roller bearings.

● Texas Electric Steel Castings Company, specialists in oil industry equipment castings, recently began operations in their new million-dollar heat treating plant, which is equipped with 11 vertical type and four car type furnaces fired by natural gas. Temperature, ranging from 1150 to 1800° F., is observed, controlled and recorded from a remote point through use of the most modern, electrically operated control system.

Link-Belt finished steel roller chains and cut tooth sprockets are used throughout this modern plant .... as drives to open and close the covers for the vertical type furnaces; as drives to operate the transfer car and the four furnace cars .... just another of the numerous types of service Link-Belt Silverlink roller chains and sprockets are satisfactorily performing in this vital industry .... just another proof of the value of 68 years' experience in manufacturing and improving dependable chain drives.

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Toronto 8. Offices, warehouses and distributors in principal cities.

In cooperation with the government conservation program, Silverlink roller chain is now furnished in a durable "blackout" finish.

LINK-BELT
Silverlink
ROLLER CHAINS

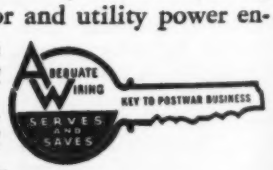
In postwar planning...

HOW is just as important as WHAT

NO MANUFACTURER can predict all the new products he will make in the next decade. But he does know that new and improved methods of *producing* them are already here—methods calling for increased use of electric power.

That's why far-seeing management is attaching such importance to *adequate wiring* . . . seeing that it's a basic part of all postwar planning. They realize that tomorrow's competitive position will depend more than ever on electric energy . . . *and adequate wiring to harness it.*

Right now is the time to find out how *your* plant's wiring system measures up . . . what it needs to meet postwar requirements. By all means, bring your electrical contractor and utility power engineer into the advance planning stage. *Unwired* planning will cost you a lot more than *planned wiring.*



46224

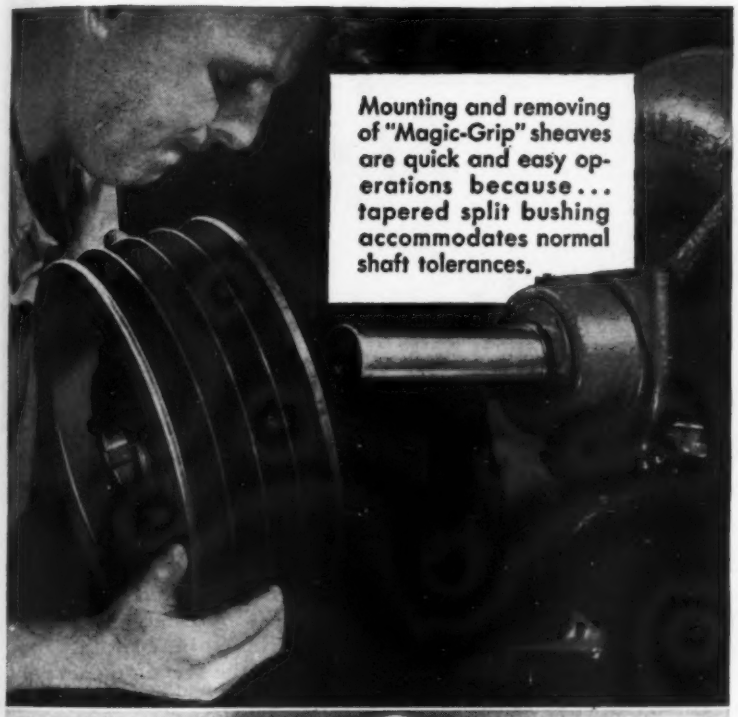
HELP BRING VICTORY SOONER . . . BUY MORE WAR BONDS

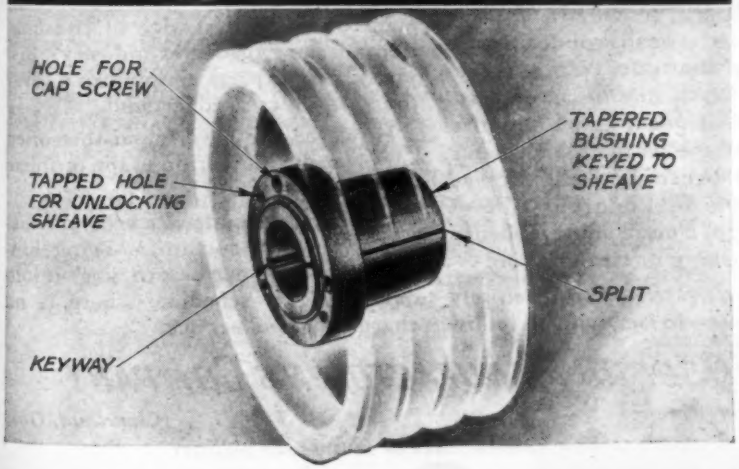
ANACONDA WIRE & CABLE COMPANY

25 Broadway, New York 4 . . . Sales Offices in Principal Cities

Electrical Wires and Cables of Copper are the Life Lines of our Nation

It saves you Man-hours and Money because it "Grips like Magic!"


Mounting and removing of "Magic-Grip" sheaves are quick and easy operations because... tapered split bushing accommodates normal shaft tolerances.



Allis-Chalmers' new "Magic-Grip" Sheave locks to shaft in one easy operation, mounts faster than any other sheave on the market. It helps conserve your motors and machines, too!

THE sheave that "grips like magic" is kind to both shafts and bearings. Its positive clamp fit allows sheave to be changed as often as desired without injury to shaft or itself. And the new design of "Magic-Grip" permits sheave to be mounted closer to motor... increasing bearing life by reducing shaft overhang.

You get smoother running performance, too, because the new "Magic-Grip" sheave is perfectly centered when installed on shaft.

Allis-Chalmers "Magic-Grip" is assembled and mounted as a unit, assuring true alignment. Its split-bushing feature allows for over- or undersized shafts... making it possible for *anyone* to mount or demount sheave easily.

And you get all these advantages at *no increase in price.* Now, more than ever, it pays to make Allis-Chalmers your "V-Belt Drive Headquarters."

"Magic-Grip" sheaves are stocked in a complete line. For full data, ask our district office or dealer for B6310. Or write ALLIS-CHALMERS, MILWAUKEE 1, WIS.

A 1683

Allis-Chalmers Texrope

"MAGIC-GRIP" SHEAVES

Maybe a Small Fixture will Speed Up PRODUCTION

Illustrated above: operator is burring and polishing 10 parts —spinning against 2 brushing wheels on the same arbor.

HAVE you a brushing job that is now being slowly, laboriously done by hand? Many plants have.

Maybe a small fixture to hold the work would make the operation more automatic—hence faster, better, cheaper.

For instance, a small wooden fixture like the one illustrated can make it possible to brush one or many parts at one time—depending on the size and shape of the work. Many plants have upped brushing efficiency as much as 500% by using this type of fixture. And got a more uniform, better burring, polishing or cleaning job!

It is Osborn's plan to work as closely with customers—in fact, with all industrial brush users—as possible. That was why we originated our famous Osborn Brushing Analysis, whereby we analyze all possible brushing operations and make recommendations.

Today, of course, it is impossible to maintain the *full* service of consultation we have placed at industry's disposal. Our experts simply can't cover the vastly increased ground.

However, we have found that often simply calling attention to the problem suggests a solution.

Of course if you have a critical situation where production is being hindered, we'll do our best to work it into our O. B. A. schedule. There is no charge for this service.

THE OSBORN MANUFACTURING COMPANY

5401 Hamilton Avenue *Cleveland, Ohio*

WORLD'S LARGEST MANUFACTURER OF BRUSHES FOR INDUSTRY

Osborn Brushes

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TO ASSURE

PRECISION PERFORMANCE!

Extreme care and constant checking at each stage in their production give Link-Belt Friction Fighter Roller Bearings the precision required for the outstanding service they are engineered to deliver.

Final production line inspection, shown above, in view taken in Link-Belt Company's Dodge plant, allows only perfect parts to be assembled and receive the Link-Belt Quality Stamp—your assurance of efficiency and long life. Friction Fighter bearings are obtainable in a wide range of sizes, roller and ball types, unmounted or mounted in pillow blocks, cartridge and flanged units, or other mountings to suit all conditions of service.

Complete description and full engineering data are contained in Book 1775-A. Write for a copy today. Link-Belt Company. Indianapolis 6, Chicago 9, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Toronto 8. Offices, factory branch stores and distributors in principal cities.

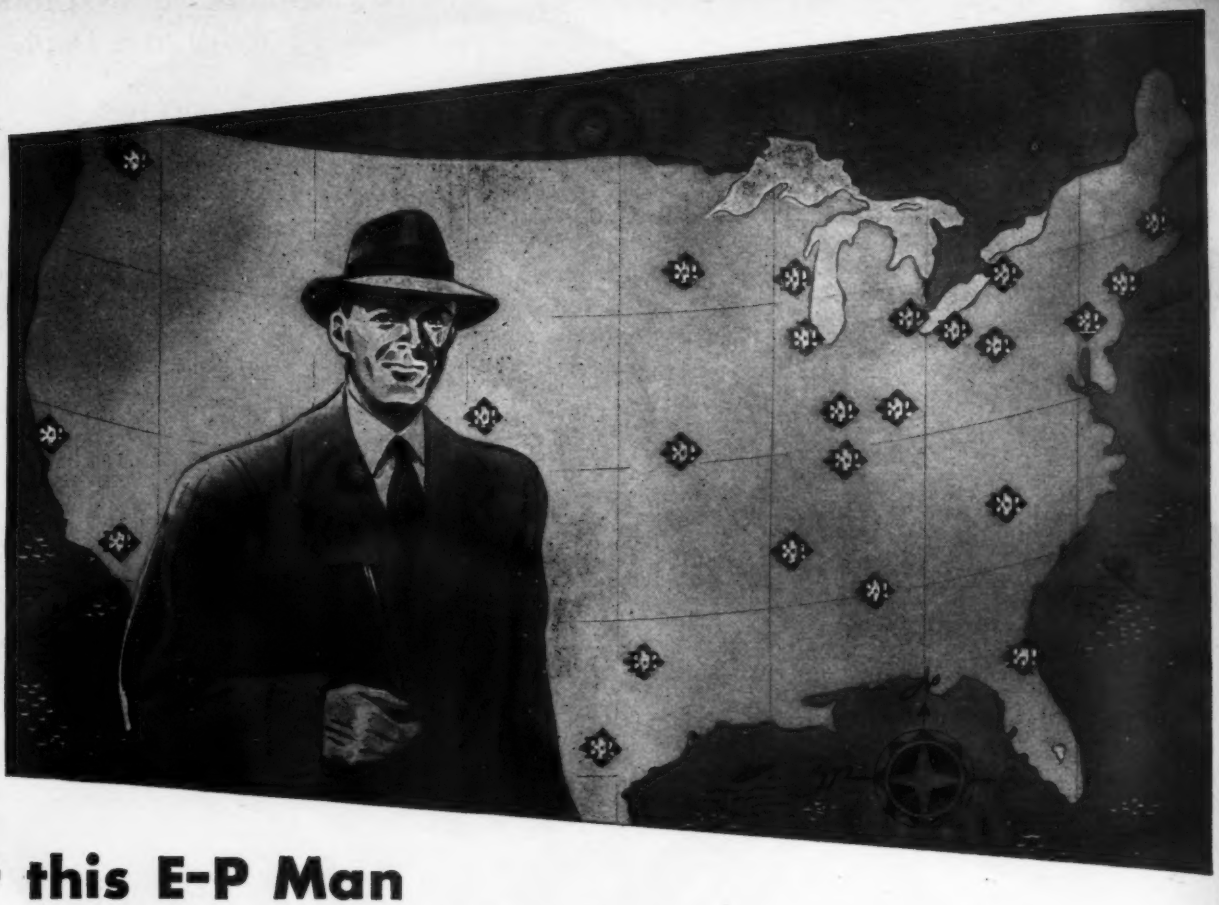
9448

LINK-BELT

THE SYMBOL OF QUALITY — LINK-BELT COMPANY

FRICTION FIGHTER BEARINGS

Roller and Ball Types



Put this E-P Man on Your Planning Board... as Transportation Advisor

You know him, of course—your local Elwell-Parker Field Engineer. As your profit plans take definite form, it will pay you to know him *better.*

For he is a trained, qualified consultant on Industrial Load Transportation—the vital concern today of your Engineering, Production and Sales Executives alike. The E-P Man can help you to organize Material-Handling Systems to move your loads without waste—in *volume*—with *speed*—with *safety.*

Your local E-P Man is supported by Elwell-Parker's vast experience covering nearly 40 years. Elwell-Parker Power Industrial Trucks and Cranes by the thousands have effected huge savings for companies large and small. All of the experience gained is available through your Elwell-Parker Field Engineer.

Appoint this man your Transportation Advisor. Take him into your confidence as you make vital decisions for your future. He is as close to you as your telephone.

The Elwell-Parker Electric Company, 4323 St. Clair Avenue, Cleveland 14, Ohio.

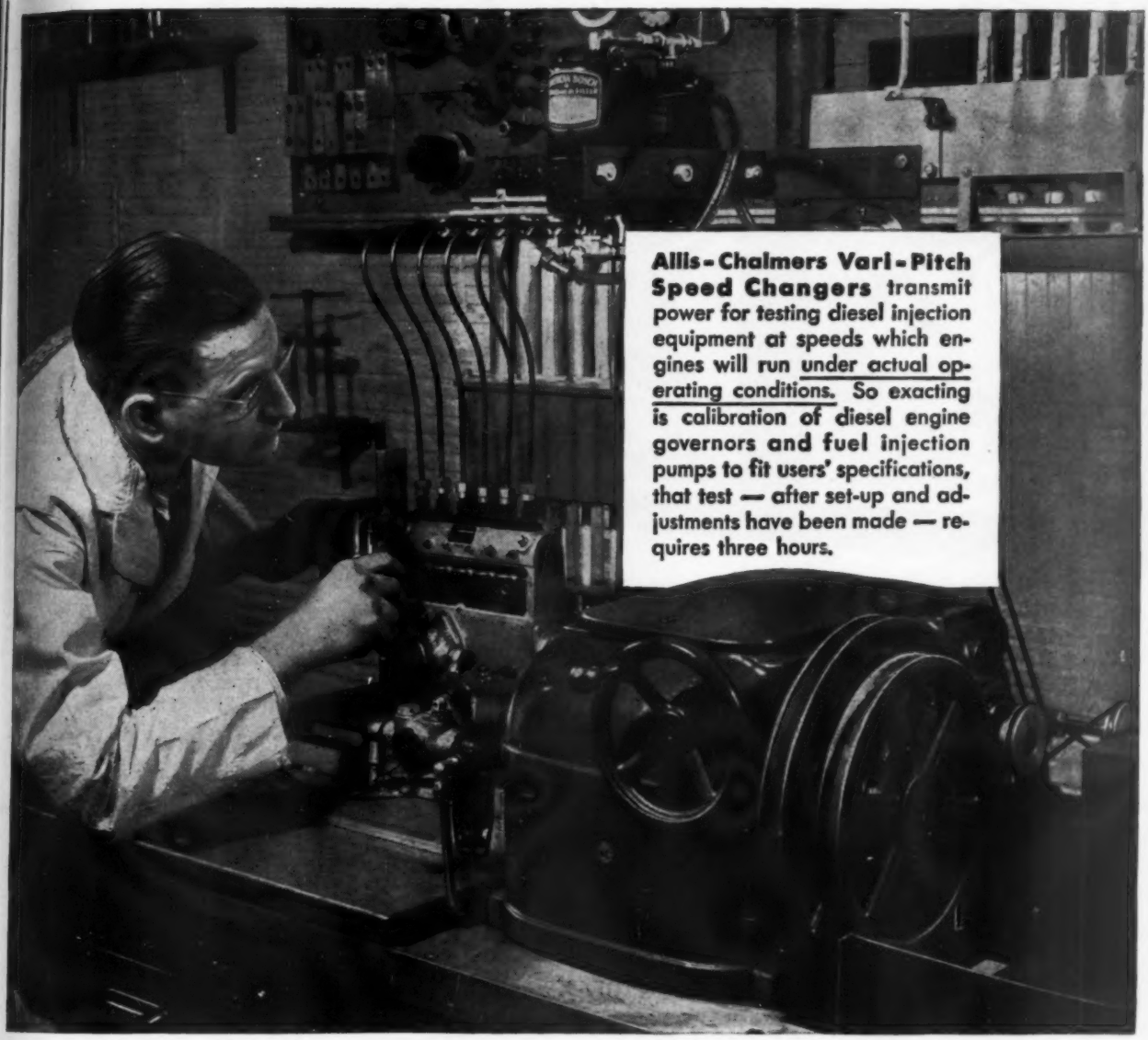
Dial the E-P Man Today!

Birmingham.....3-3323	Cleveland.....MA 8915	Kansas City.....VA 7021	Philadelphia.....LOM 3710
Boston.....COM 5522	Denver.....KE 5500	Los Angeles.....PR 5911	Pittsburgh.....AT 6734
Buffalo.....GR 7664	Detroit.....MA 2233	Memphis.....8-1648	San Antonio.....TR 3653
Charlotte.....5026	Ft. Worth.....4-6184	Milwaukee.....MA 7817	San Francisco.....GA 1827
Chicago.....SUP 7420	Indianapolis.....LI 3131	Minneapolis.....GE 3247	Seattle.....EL 5722
Cincinnati.....MA 0650	Jacksonville.....5-1384	New York.....COR 7-0797	St. Louis.....LA 4545

ELWELL-PARKER

POWER INDUSTRIAL TRUCKS

PRODUCT OF THE MONTH



Allis-Chalmers Vari-Pitch Speed Changers transmit power for testing diesel injection equipment at speeds which engines will run under actual operating conditions. So exacting is calibration of diesel engine governors and fuel injection pumps to fit users' specifications, that test — after set-up and adjustments have been made — requires three hours.

MILWAUKEE, WIS.—Allis-Chalmers Vari-Pitch Speed Changers supply unwavering power to precision machines calibrating diesel engine governors and fuel injection pumps . . . where clearances of 39/1,000,000 of an inch can be measured only by oil leak-off, not by micrometer. Send for B6013.

A 1704

WE WORK FOR VICTORY · WE PLAN FOR PEACE

ALLIS-CHALMERS · MILWAUKEE · WISCONSIN

Today's Most Practical and Constant Medium of Communication from Management to Men

YOUR COMPANY NAME
FALLS
FALLS are the average worker's greatest daily DANGER
BE CAREFUL AGAIN TODAY!
I've got a date with VICTORY! So I'm sticking to my own little job until the big job is done!
A THOUGHT A TODAY
Every Broken Tool

at a cost of only about 1c per employee per week

WHAT *you* CAN DO WITH A WELL-PLANNED BULLETIN BOARD SERVICE IN *your* PLANT

Today both management and men have one common problem—the TIME ELEMENT. Ability to get management's important messages to the men and women in the shop requires a time-saving, effective method of communication.

ELLIOTT BULLETIN BOARD SERVICE—tried and proved over the years in many plants—fits today's needs because it provides a direct, daily medium for getting attention quickly to management's messages and stimulating workers to THINK, REASON and ACT.

With ELLIOTT BULLETIN BOARD SERVICE in your plant, you can keep in touch with your workers and enlist their cooperation in solving many problems which concern both management and men.

For example, your messages via the bulletin board can deal with production, quality workmanship, costs, accident prevention, health, waste reduction, absenteeism, suggestions, etc. Then, too, the bulletin board is a necessary medium for plant notices, rules, announcements—for in-the-plant publicity—for getting management's policies and purposes clearly and quickly into the minds of the rank and file of wage earners. Thus, confidence, based on an understanding of management's motives, can be built up and maintained.

If you are concerned with influencing employee attitudes favorably—if you have any problems that lend themselves to solution by the mass education of your workers—you'll want to know more about ELLIOTT BULLETIN BOARD SERVICE and its successful use in industry. Ask for further information.

Elliott Service Co., 219 E. 44th St., N. Y. 17, N. Y.

● MAIL COUPON TODAY FOR DETAILS OF ELLIOTT BULLETIN BOARD SERVICE ●

Elliott Service Co., 219 E. 44th St., New York 17, N. Y.
Kindly send me further information on ELLIOTT BULLETIN BOARD SERVICE It is understood that our request incurs no obligation on our part.

Name ..... Company .....

Position ..... Address .....

SERVICE DEVELOPED THRU 33 YEARS OF CONSTANT CONTACT WITH INDUSTRY

[PUMP TIPS FROM ALLIS-CHALMERS—ONE IN A SERIES]

How to make SHAFTS Last Longer . . .

The Allis-Chalmers "Electrifugal" Pump is a unit-designed pump . . . with both impeller and motor mounted on one shaft and in one frame. The next time you need new pumps . . . look into the extra efficiency, ruggedness and long life of Allis-Chalmers centrifugal pumps . . . the "Electrifugal" . . . and all types for every purpose.

WHERE YOU HAVE an Allis-Chalmers "Electrifugal" Pump . . . shaft and rotor pictured at left . . . you don't have an alignment problem—because *both* impeller and rotor are mounted on *one* shaft.

However, many pumps in use today are coupled to a separate motor, and how well the two are aligned has a lot to do with how long the shaft lasts . . . and the pump and coupling too . . . because misalignment starts all three fighting each other!

Here are a few tips which will help you get longer life out of pump shafts:

▶ See that pump and motor coupling flanges are parallel . . . both vertically and axially . . . and that they are kept that way!

▶ If misalignment recurs frequently, check foundations, piping, bolted connections.

▶ In the case of boiler feed or other pumps which reach high operating temperatures, be sure that alignment of motor and pump is checked after *both* have been operating. Otherwise they might develop misalignment from unequal expansion.

▶ If you haven't done so already, send for your *free* copy of "Handbook for Wartime Care of Centrifugal Pumps". Contains *no* advertising. ALLIS-CHALMERS MFG. CO., MILWAUKEE 1, WISCONSIN. A 1707

Tune in the Boston Symphony, Blue Network, every Saturday at 8:30 pm, EWT.

ALLIS-CHALMERS PUMPS

Allis-Chalmers builds all types and variations of pumps shown at right. Capacities from 10 to 150,000 gpm—heads to 2500 lbs.

Single Suction · Double Suction · Double Suction Multi-Stage · Open Impeller · Mixed Flow · Axial Flow (Propeller)

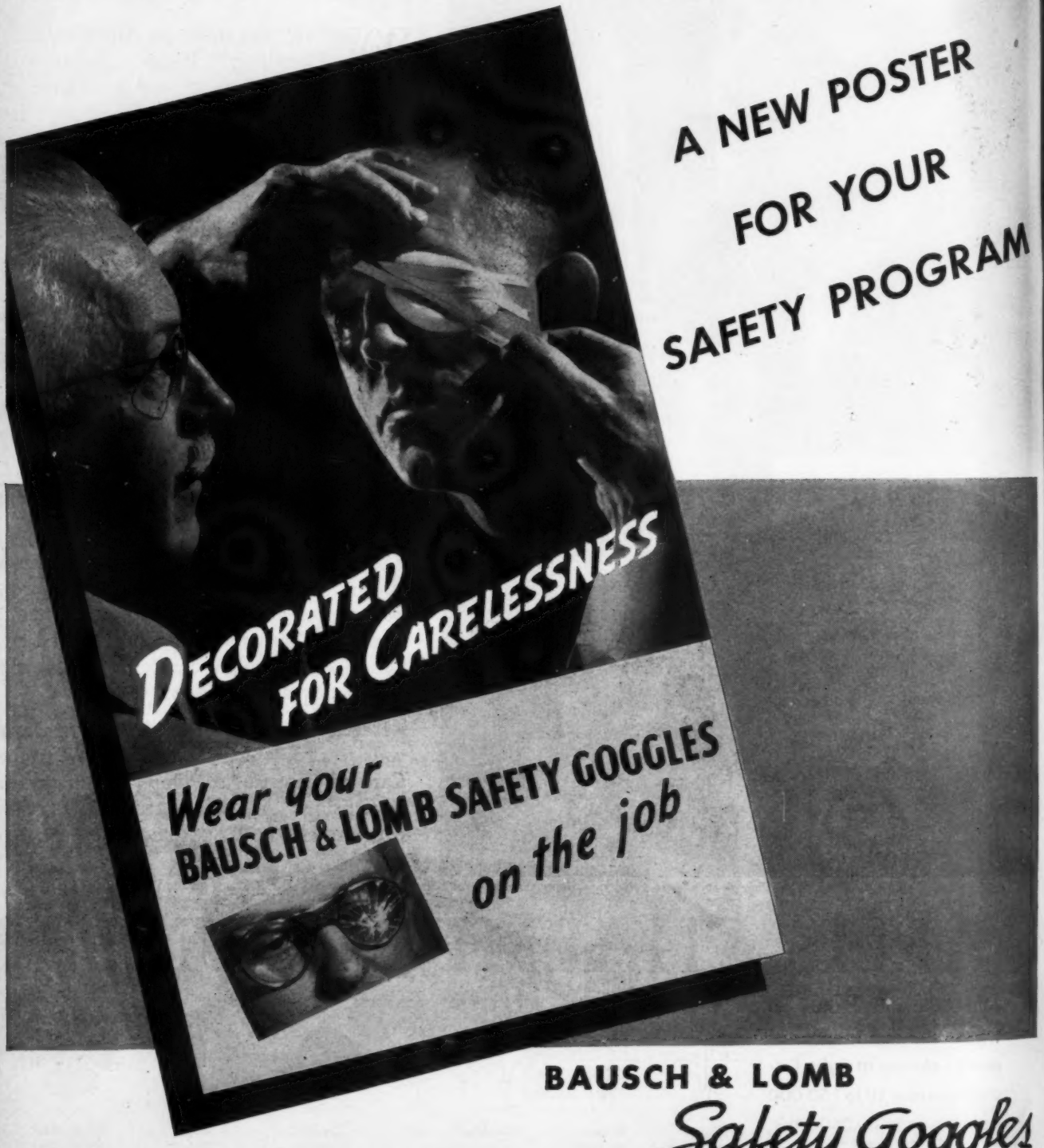
How to get Workers to Wear Safety Goggles

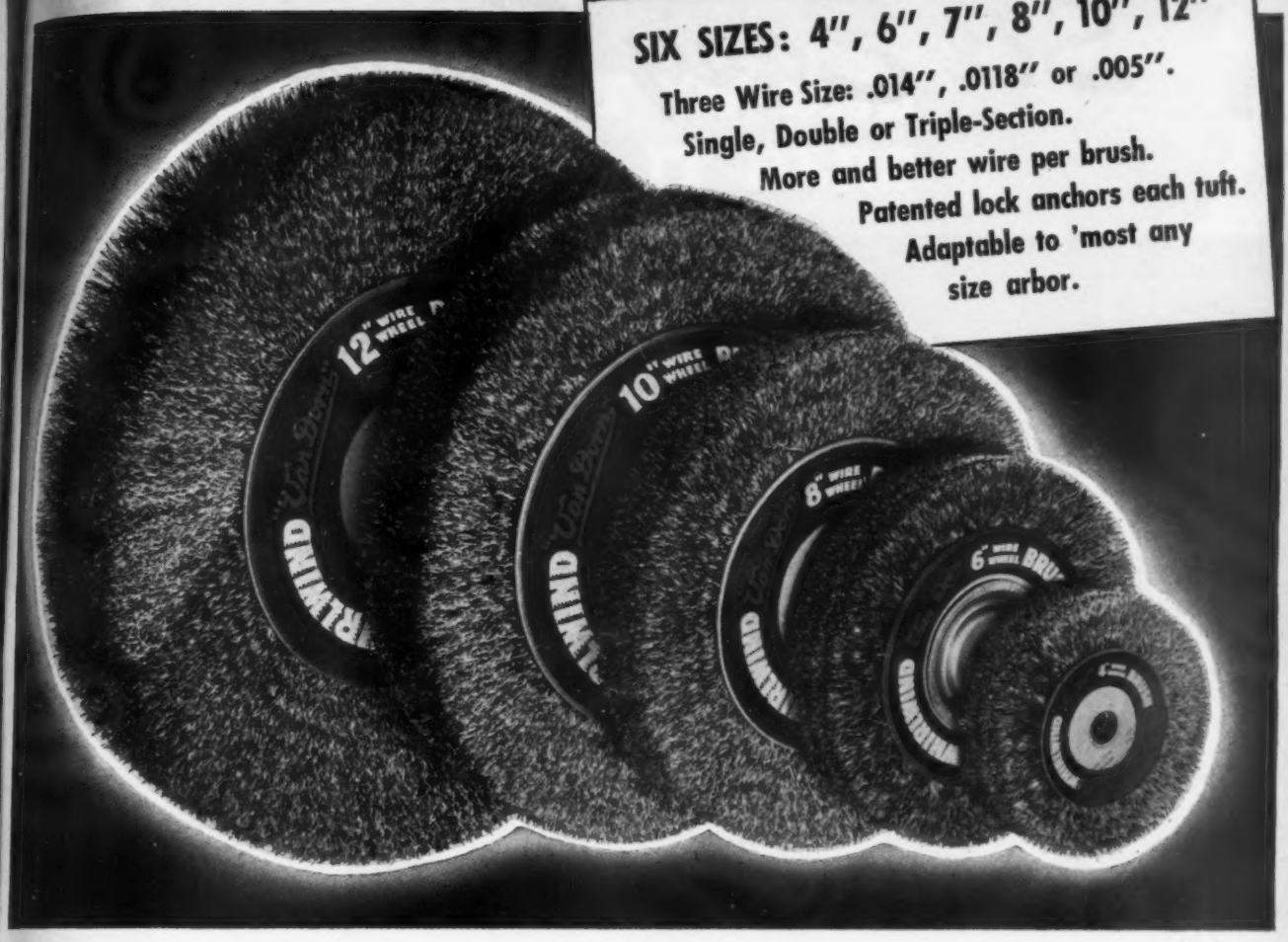
The value of Bausch & Lomb safety goggles in reducing eye injury is universally recognized. Their sturdiness and high impact resistance has made them the standard in those plants where the worker's safety is paramount.

Furnished with plano lenses or with prescription ground lenses to remedy unnecessary visual handicaps, they become a part of every worker's equipment—for better eye protection, better vision.

To help you in your safety campaign and supplement your efforts in conserving efficient visual standards, Bausch & Lomb is issuing a series of bulletin board posters stressing the importance of wearing safety goggles. The latest in this series, shown above, dramatizes the result of negligence and urges the use of safety goggles wherever eye hazards may be encountered. Its simple forceful message is one that workers will understand and heed.

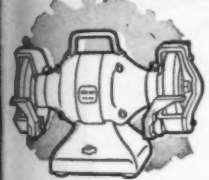
A supply sufficient for your bulletin board requirements will be sent you on request. Their size is 13¾" x 21¾". Just write to Bausch & Lomb Optical Co., 650 St. Paul St., Rochester, N. Y.




SIX SIZES: 4", 6", 7", 8", 10", 12"
Three Wire Size: .014", .0118" or .005".
Single, Double or Triple-Section.
More and better wire per brush.
Patented lock anchors each tuft.
Adaptable to 'most any size arbor.
12" WIRE WHEEL
10" WIRE WHEEL
8" WIRE WHEEL
6" WIRE WHEEL

Yes, the Best Wire Brushes are Van Dorn Whirlwinds!

War industry's toughest jobs have proved it! Van Dorn *Whirlwind* Wire Wheel Brushes are better, tougher, denser, stand up longer, do more and better work. Just check those features above, and remember this: Made by Van Dorn, on special Van Dorn machines, these *Whirlwind* Brushes have each tuft of wire anchored in place by a patented lock . . . separately . . . securely . . . to stay! What's more, you can use these *Whirlwind* Brushes, not only with powerful Van Dorn Bench Grinders, Portable Grinders and Sanders, but on practically all types of grinding, buffing, polishing and cleaning machines. Next time you need wire wheel brushes, order Van Dorn *Whirlwinds.* There's a Van Dorn Jobber near you as a ready source of supply on the complete Van Dorn line. The Van Dorn Electric Tool Co., 719 Joppa Road, Towson-4, Maryland.



BENCH GRINDER

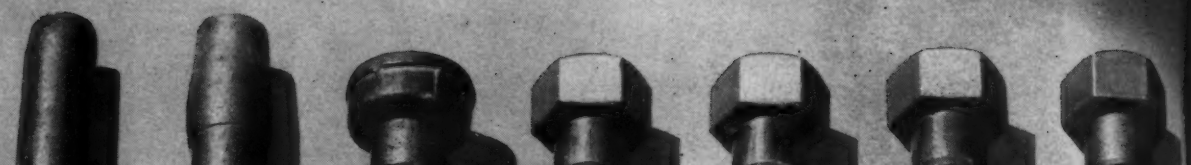
"Van Dorn"

(DIV. OF BLACK & DECKER MFG. CO.)

PORTABLE GRINDER

PORTABLE ELECTRIC TOOLS

Six Easy Steps . . . .



It takes only ONE SECOND to make this hexagon head bolt —which is representative of modern bolt manufacturing methods. If milled from hexagon bar stock it would take more than ONE MINUTE to produce.

When this bolt is finished, it is ready for heat treatment, represented by the *seventh step, above*. This last operation is necessary to attain prescribed physicals regardless of its method of manufacture.

IN MAKING A BOLT IN ONE SECOND..AS WE DO IT HERE AT LAMSON & SESSIONS . . .

To make 100,000 ⅜″ x 2″ hexagon head bolts from bar stock we start with 48,700 lbs. of raw material. When we have produced 100,000 bolts, they weigh but 24,300 lbs. Our scrap loss is nearly 12½ tons of raw material or about 50%.

To make this hexagon head bolt from round wire on bolt-making machinery we start with 26,100 lbs. of raw material. When we have produced 100,000 bolts they also weigh but 24,300 lbs. Hardly 5% of material used becomes scrap!

The difference between the weight of raw material required for manufacture from hexagon bar stock and the weight of raw material required for manufacture from round wire is 22,600 lbs.—which is the amount of critical raw materials the bolt manufacturer avoided (1) buying, (2) stocking, (3) consuming, (4) converting to scrap, and (5) causing to be re-melted and re-fabricated!

It is important to realize that bolt manufacturers can make bolts by the upsetting or cold forging method from round wire up to ⅞-inch diameter, if they have the necessary equipment as does Lamson & Sessions.

If you need only a dozen bolts of a certain size or type you can afford to make them by milling from the hexagon bar—unless they are "standard" bolts of a size stocked by your jobber.

If you need (or think you need) a "special" bolt—before you make it yourself—find out if you really need the special design or size, or if you can adapt *your assembly design* to use existing "standard" bolt types and dimensions and materials—to save time and get as good a product. In most instances—we've found that you can!

If the information we offer you in our Lamson Blue Book, our standard catalog, isn't sufficient to answer your questions—write us or ask a representative to call before you decide upon a *special* bolt that would require *special* dies, *special* production methods and *special* inspections at every step in its manufacture. If you can use a "standard" product made from existing dies on bolt-making machinery, you have obtained the utmost efficiency—*and you've really "standardized."* Make it a rule for the duration—use a "standard" bolt whenever you possibly can.

THE LAMSON & SESSIONS COMPANY, General Offices, Cleveland, O.

"BOLTS ARE IMPORTANT!"—24-page booklet of currently useful information for buyers of headed and threaded products, and describing Lamson & Sessions' specialty fastenings which have wide industrial applications—*now, and in the post-war period.*

"THE LAMSON BLUE BOOK"—is our standard Catalog of standard products excepting our Aircraft products.

"BOLTS, NUTS & SCREWS"—70 pages of technical and practical information. First copy gratis, requested on your letterhead. Additional copies one dollar each.

"SIMPLIFIED STOCK LIST"—Of bolts, nuts and screws, conforming to latest revisions of the Office of Price Administration, and of great value in showing you in what ratio quantities of various standard products are kept in stock for deliveries, by your jobbers and in our own (and other bolt manufacturers') warehouse stocks.

HERE'S A COUPON FOR YOUR CONVENIENCE

THE LAMSON & SESSIONS COMPANY • 1971 West 85th Street • Cleveland 2, Ohio

Please send us ☐ Lamson Blue Book ☐ Bolts, Nuts & Screws
☐ Bolts are Important! ☐ Simplified Stock Sizes

Name of Individual _____ Title or Kind of Work _____

Employed by (Name of Company) _____

Street Address _____

City and State _____

No. 1898—Copyright 1944—The Lamson & Sessions Co.

LAMSON & SESSIONS

BOLTS · · NUTS · · COTTERS · · CAP SCREWS · · SPECIALS

Your Jobber Stocks the Lamson Line

*COLOR...

TIDE WATER LUBRICANIA

DEFINITION: For practical purposes, the color of an oil is expressed as a "number" which is determined by matching the light transmitted through a pre-determined depth of oil with that same light transmitted through numbered and standardized glasses or disks.

EXPLANATION OF TESTS USED: The American Society for Testing Materials have selected two instruments for determining the color of petroleum products. These instruments are:

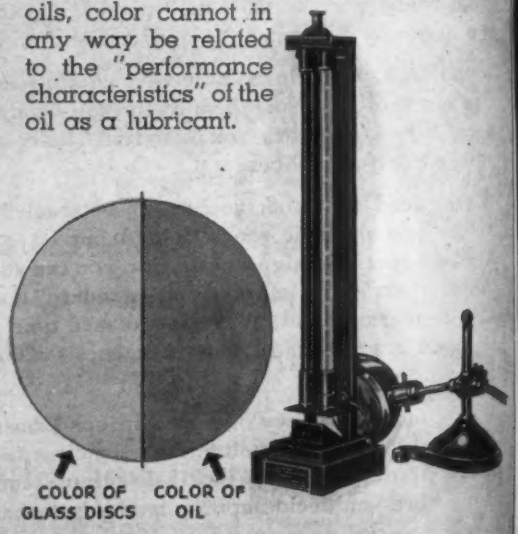
(1) **The Saybolt Chromometer** for making color determinations on the lighter oils.
(2) **The Union Colorimeter** for determining color on the "pale-straw" and darker products.

THE SAYBOLT CHROMOMETER consists of two vertical glass tubes. One of these tubes is of plain glass, open at both ends with provision for holding one or two colored glasses or disks at the lower end. The other tube is closed at the lower end with a colorless plate and is provided with a drain cock. This tube is graduated. A mirror reflects light through the oil and the tubes into an optical prism-eye piece for matching the light passing through the oil with the light passing through the disks. The color scale for light oils varies from minus 16 to plus 30.

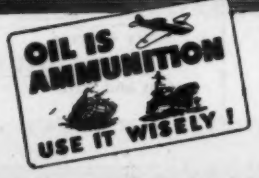
THE UNION COLORIMETER: In the Union Colorimeter the N. P. A. or A. S. T. M. color of the oil is obtained by matching one of a series of fixed color standards against a sample of oil. The comparison is observed through a circular aperture at the end of a long rectangular box. The color standards are mounted at one end of the box in a vertical magazine which may be moved up and down by means of a knurled hand knob operating a ratchet and gear.

The method used for matching colors on both the Saybolt Chromometer and the Union Colorimeter follow a carefully prescribed procedure outlined under A. S. T. M. Designations D156-38 and D155-39T respectively.

SIGNIFICANCE: Color is of importance in the case of certain light petroleum fractions, particularly products used in dry cleaning or in the textile industry, where the use of colored products might discolor the fabric being treated. The chief significance of color as applied to the darker oils is in the fact that it is a generally accepted index of the uniformity of a given grade or brand. In these oils, color cannot in any way be related to the "performance characteristics" of the oil as a lubricant.



INDUSTRIAL TYCOL OILS-GREASES



DRUMS! DRUMS! DRUMS!
War needs make it extremely important that all empty drums be returned immediately.

SCIENTIFICALLY ENGINEERED FOR EVERY INDUSTRIAL USE **TYCOL**

* This is the 8th of a series of informative messages concerning the meaning and significance of commonly used tests and terms employed to describe the characteristics of lubricating oils.

All Tycol oils and greases are subject to rigid tests to control the uniform quality of manufacturing. They are manufactured in a comprehensive line so as to meet every specific operating requirement. It is the combination of the unvarying high quality of Tycol products and the scope of the line that makes possible the unexcelled performance of Tycol lubricants for Industry.

TIDE WATER ASSOCIATED OIL COMPANY

MAKERS OF THE FAMOUS VEEDOL MOTOR OIL • Eastern Division: 17 Battery Place, New York 4, N. Y.

Principal Branch Offices: **Boston, Philadelphia, Pittsburgh, Charlotte, N. C.**

a world did you say?

Omaha Public Library
Reference Dept.

That's young America speaking. Are we thinking and living in our past? Or are we staying young for and with our kids? Stop! Look! Think!

Remember when you could name the various makes of automobiles as fast as they flashed by? Your boy can do the same . . . with airplanes. You played with toy electric trains. Your youngster builds model gliders. You and your gang thought you were "hot stuff" when you owned and drove a jalopy Model T. Your son looks forward to membership in a flying club and part ownership of a cozy cabin plane.

That lad with the little red wagon and sand bucket has grown up. Today, he is winning a war for us. What will we have ready for him when he returns to "peacework"? When war production at any cost gives way to product production at lowest cost? He'll be deserving of a good turn, then. In lathes, it's LeBlond. They turn at a profit as they true a product.

THE R.K. Le BLOND MACHINE TOOL CO., CINCINNATI, 8

NEW YORK 13, 103 Lafayette St. CAnal 6-5281

CHICAGO 6, 20 N. Wacker Dr. STA 5561

Check-Clip-Mail

FOR ILLUSTRATED SPECIFICATIONS:

- ☐ HEAVY DUTY GEARED HEAD ENGINE LATHES
- ☐ TOOL ROOM LATHES
- ☐ AUTOMATIC LATHES
- ☐ HEAVY DUTY GEARED HEAD GAP LATHES
- ☐ SUPER REGAL GEARED HEAD LATHES
- ☐ RAPID PRODUCTION LATHES
- ☐ AUTOMATIC CRANKSHAFT LATHES
- ☐ No. 2 CUTTER GRINDER

YOUR NAME _____ TITLE _____

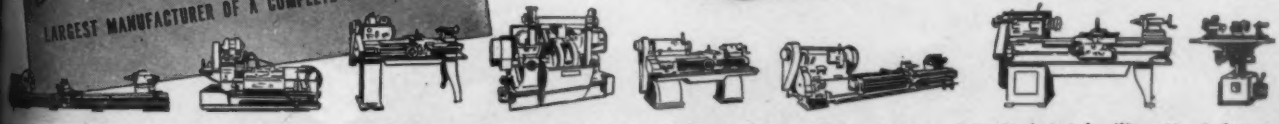
YOUR FIRM _____ ADDRESS _____

time to retool
Turn to LeBlond for Turning Equipment
LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

ARMY-E-NAVY

LEBLOND

★ YOUR BONDS BUY BOMBS ★
BUY A "BLOCK-BUSTER" TODAY!



HD Engine Lathes—Nine sizes ranging from 12" to 50" swings. For versatility in turning.

Automatic Lathes—12" & 16" Mechanical or Hydraulic power.

Super Regal Lathes—Six sizes, 13" to 24" Best for training.

Automatic Crankshaft Lathes—For all facing, turning, finishing, pins.

Tool Room Lathes—12", 14", 16" and 18" swings. Versatile.

HD Gap Lathes—Ten sizes in Regular and Sliding Gap models.

Rapid Production Lathes—13", 17", 20" swings. Six speeds. Faster output. Lower cost.

No. 2 Cutter Grinder—Internal, cylindrical, face and angular work.

We never knew what this machine could do

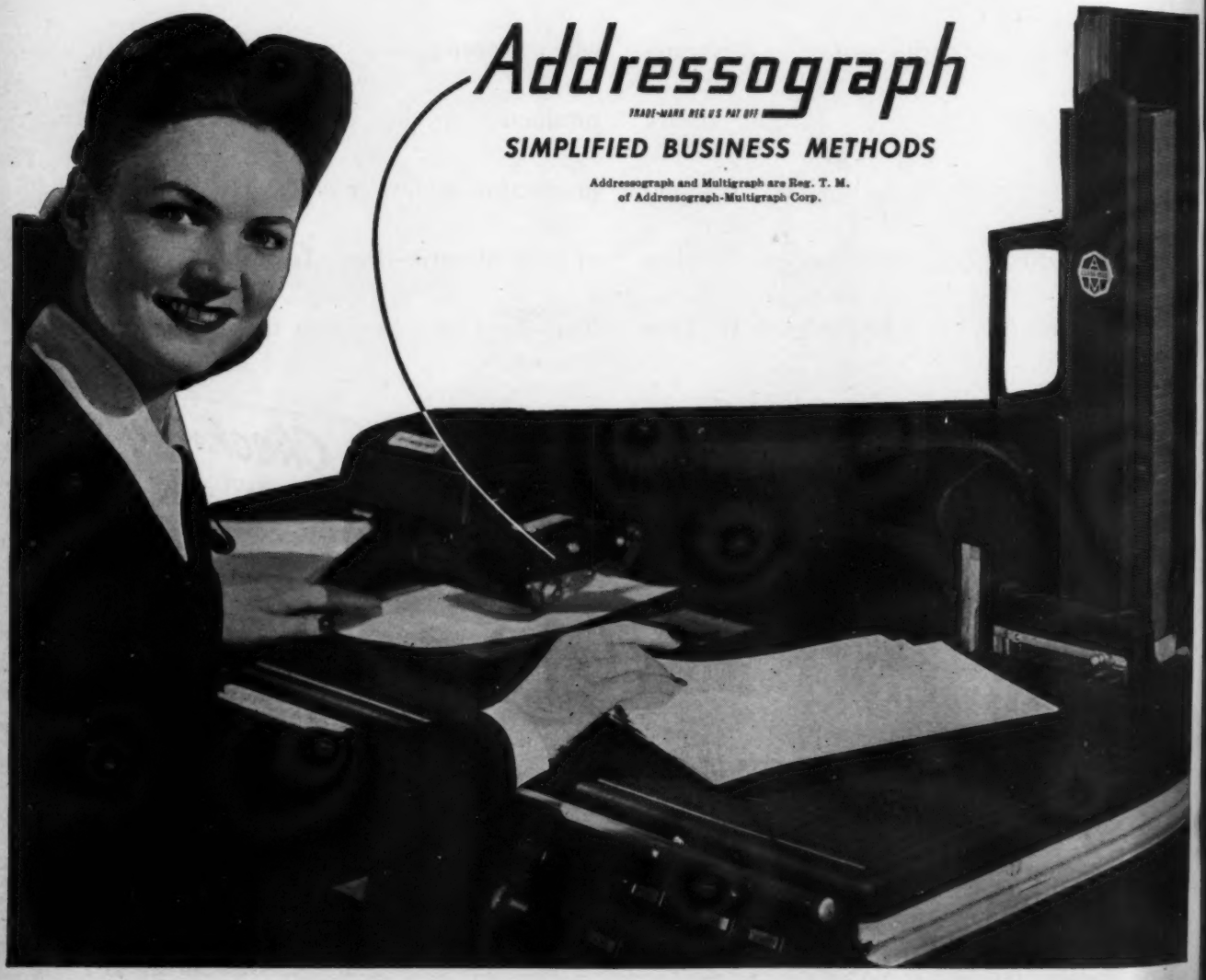
SURE—we knew right along that Addressograph machines could write business forms and records at the rate of 85 a minute—with 100% accuracy.

We knew that before the war these machines were cutting costs and saving time in payroll writing, inventory taking, check writing and dozens of other office procedures.

Then war came. And with it the need for speed-up in all phases of business—factory, office, warehouse, shipping room. Soon Addressograph users were telling *us* that their machines were being used for production control, tool crib control, War Bond writing, allotment check writing, parts identification and countless other war jobs—many of them *new* applications.

Almost daily we hear of new ways to simplify business methods with Addressograph equipment. So broad are the possibilities we may never find out all the things it can do.

Addressograph (and Multigraph, made by the same company) can speed up the handling of 80% of all paper work in business. If you are an Addressograph user, chances are we can help you extend the use of your equipment—save time and money. We will be glad to show you how. Write or call Addressograph-Multigraph Corporation—Cleveland and all principal cities.



Addressograph

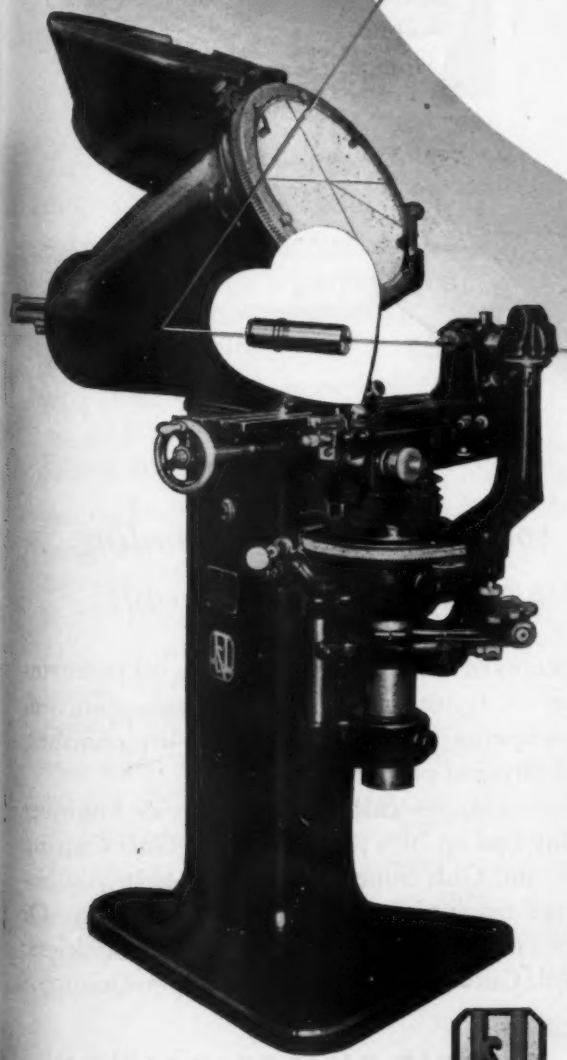
TRADE-MARK REG U.S. PAT OFF

SIMPLIFIED BUSINESS METHODS

Addressograph and Multigraph are Reg. T. M. of Addressograph-Multigraph Corp.

Rx FOR HEART TROUBLE

on optical inspection equipment



The lens system is the *heart* of every optical inspection machine. Without perfection in this system—without special lenses, precision cells and housings—without optically flat mirrors, heart trouble results. This means distortion, fuzzy edges, and prismatic colors on the shadow image—inspection that is *fatal* to production.

Your protection against heart trouble is the **Jones & Lamson Optical Comparators.** For the lens system of each machine is literally prescription-designed by Jones & Lamson inspection engineers and built to those specifications by their own craftsmen. This highly specialized lens system, so necessary for inspection by optical projection, is your guarantee of trouble-free performance. The shadow image on every **Jones & Lamson Comparator** is dark, clear and sharp. It is absolutely accurate over the *entire* chart glass. The light around the image is entirely free from prismatic coloring.

For accurate, rapid, economical inspection . . .
BEYOND A SHADOW OF A DOUBT!

●

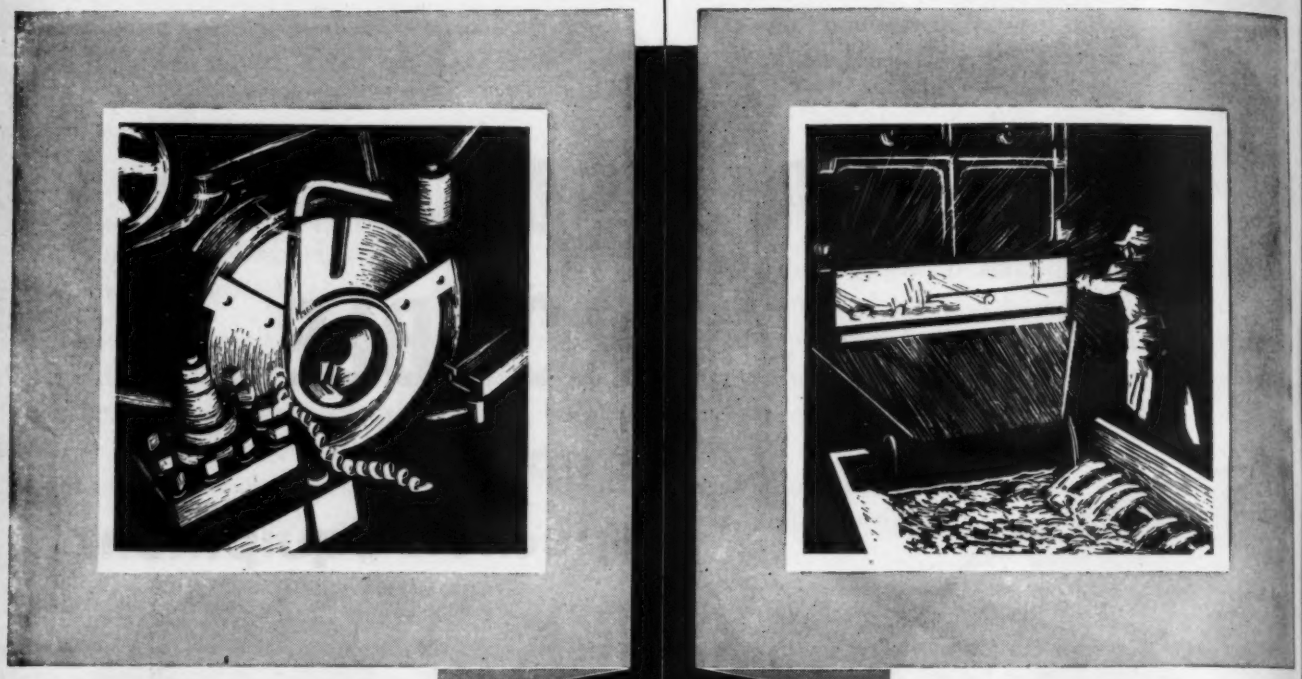
Manufacturers of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies

PROFIT-PRODUCING MACHINE TOOLS

JONES & LAMSON
MACHINE COMPANY
OPTICAL COMPARATORS

Springfield, Vermont, U.S.A.

Are you tapping these proven sources of greater production efficiency?



GULF CUTTING OILS **GULF SUPER-QUENCH**

Let a Gulf Service Engineer show you how these outstanding Gulf products can help you increase output and reduce costs

Here's why Gulf Cutting Oils and Gulf Super-Quench should have a prominent place in your plans for increased production:

A long list of metal parts for the nation's war machine—some of them probably similar to parts you are making — are being produced faster, better, and at lower cost with these superior cutting and quenching oils!

In many cases, Gulf Cutting Oils and Gulf Super-Quench have revolutionized existing concepts of cutting and quenching oil performance — resulting directly in outstanding improvements in production, tool life, finishes, and physical properties.

Investigate—call in a Gulf Service Engineer today and let him show you how Gulf Cutting Oils and Gulf Super-Quench can help you improve machining and quenching practice. Or write for your copy of each of these booklets: "Gulf Cutting Oils" and "Gulf Super-Quench."

GULF INDUSTRIAL LUBRICATION

Lubricants for every industry

GULF OIL CORPORATION
GULF REFINING COMPANY
GULF BUILDING, PITTSBURGH, PA.

Veteran in Search of a Peacetime Future

THIS veteran knows of no job to come back to after the war.

It was born of war necessity — built to perform a strategic purpose new in the history of aircraft.

The requirements were an engineering challenge. It had to be strong to do its heavy work. Yet it had to be light and fit in the small space available.

That is why even optimists doubted such a device could be built.

But here it is: The Lear Actuator.

Its job is operating flaps, landing gears, shutters and other equipment on the power of an airplane storage battery.

Now, of course, our plants are working round the clock to make enough of these for the fighting ships of Uncle Sam.

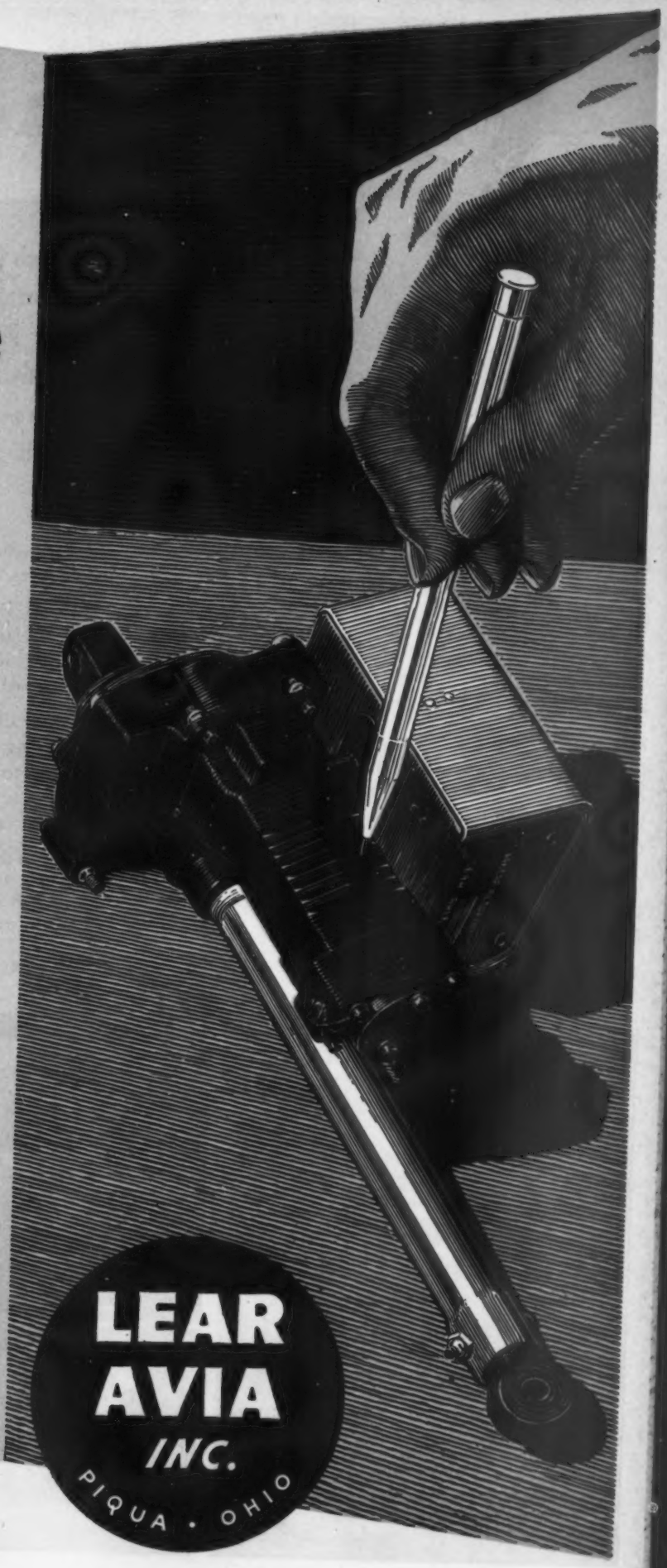
But we know that such unique devices, the midget motors that drive them and all the 250 Lear products, must have an important future in some peacetime products.

They may park your car with the push of a button — or do any of thousands of jobs we haven't thought of.

That is why we are telling you about them. We want to find jobs for these able veterans.

And we want you to know that the kind of engineering thinking and production technique that made them possible is available.

PLANTS: Piqua, O., and Grand Rapids, Mich. BRANCHES AT: New York, Los Angeles, Chicago, Detroit, Cleveland, Providence.



"So men may

Crash landings at sea used to mean "curtains." Now, more and more of our fliers come back . . . thanks to modern life rafts. Today's improved *"See-ability"* is helping workmen build them faster — and better . . .

Let's suppose you're flying a patrol and run out of gas far at sea. Your engine sputters, dies and—down you come.

A tough spot . . . but almost before your ship hits the water you're clear and aboard the rubber raft stowed away for just such emergencies.

Rugged, sea-worthy, these amazing boats have kept fliers and their crews afloat for weeks! No wonder they can take it—when you realize how carefully they are built; how rigidly materials and workmanship are tested and re-tested!

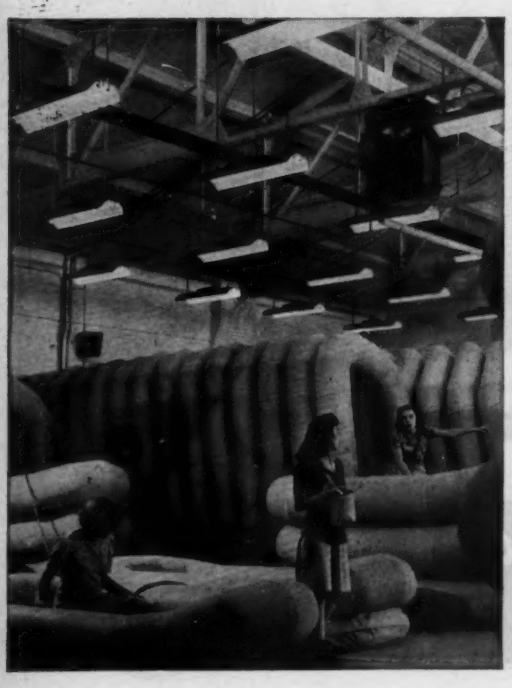
On this life-and-death job "See-ability" through modern improved lighting is playing an important role. It is helping eyes and fingers do their work faster, more efficiently. It is speeding production—reducing "rejects," increasing quality.

In fact, in this as well as other vital war work, millions of Westinghouse Mazda Lamps are bringing better "See-ability," helping set new peacetime lighting standards for the industrial world of tomorrow.

You will find some helpful suggestions on industrial lighting in a booklet "See-ability for Indoor Eyes." Write to the Westinghouse Electric and Manufacturing Company, Lamp Division, Bloomfield, New Jersey. *Plants in 25 cities . . . offices everywhere.*

Easy on the eyes (*opposite page*) . . . Looking for broken threads in boat fabric. Here the operator must look directly into the light. How significant that Westinghouse Mazda Fluorescent Lamps were chosen for this critical task!

KEEP YOUR DOLLARS FIGHTING . . . BUY WAR BONDS



live to fight again!"

"PUT IT ON THE BLANCHARD"

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

★ **Production**

Adaptability

Fixture Saving

Operation Saving

Material Saving

★ **Fine Finish**

★ **Flatness**

★ **Close Limits**

★ . . . . . *Especially valuable on jobs like the one illustrated.*

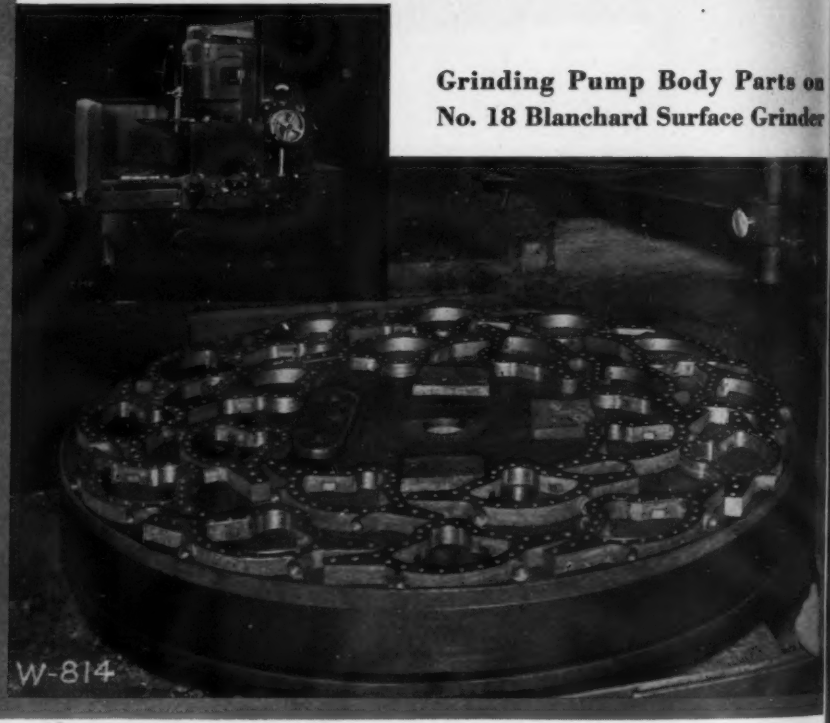
THIS is an excellent example of accurate surface grinding of pump body parts on a No. 18 Blanchard Surface Grinder.

These pump parts are held magnetically on a 36" chuck and work is held to very close limits giving a finish suitable for final lapping operation.

The material is high strength forged steel and .004" is removed from each side, to limits of .0003". Forty pieces 10⅝" long, 5⅛" wide and .756" thick (80 surfaces) are produced per hour.

The **BLANCHARD MACHINE COMPANY**

64 STATE STREET, CAMBRIDGE, MASS.



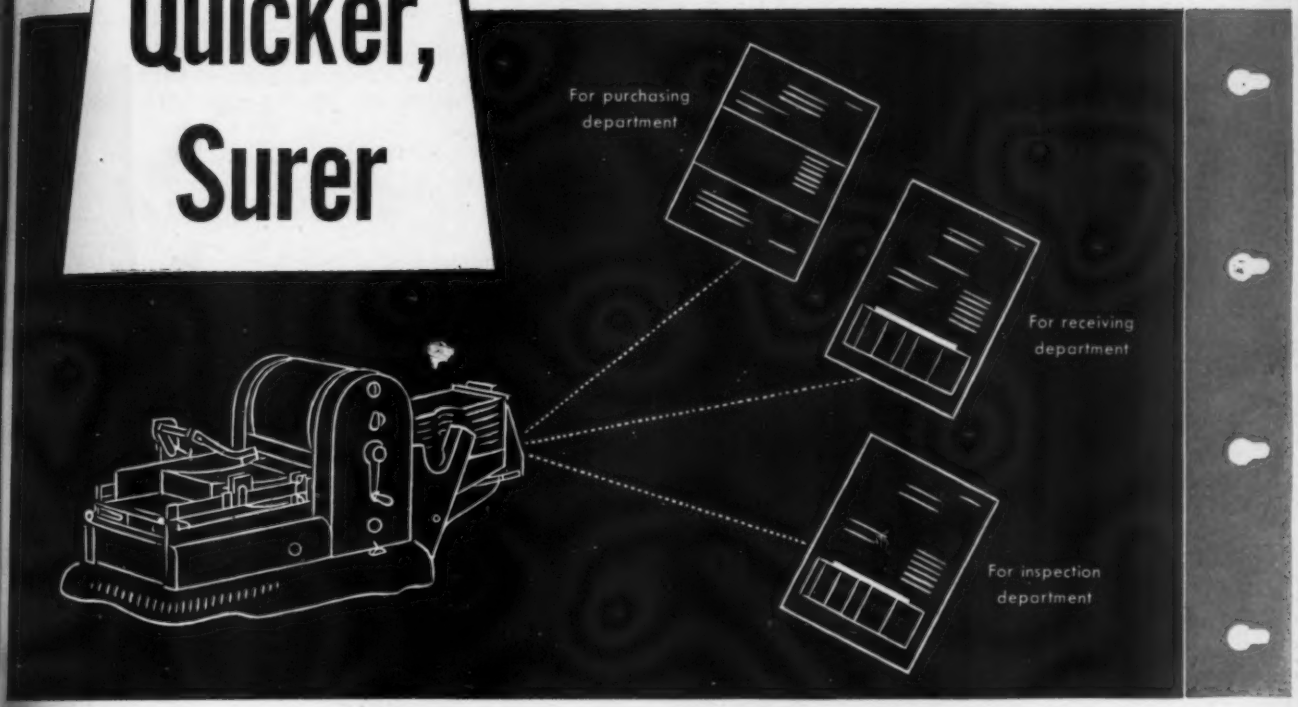
Grinding Pump Body Parts on No. 18 Blanchard Surface Grinder

BLANCHARD

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

Easier, Quicker, Surer

The new Mimeograph one-writing system of order control



All copies are identical

Now, purchasing, receiving, inspection and material control can be completely correlated, with sure and accurate control all along the line.

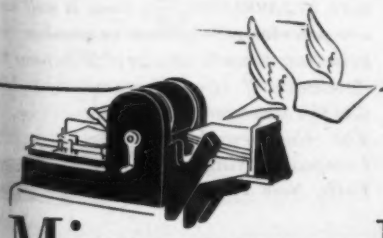
A single writing with Mimeograph duplication is the key to this new system.

A single writing on a Mimeograph form-topped stencil sheet produces on the Mimeograph duplicator a combination purchase order with receiving and inspection forms. Each is produced in sufficient quantity to go to everyone concerned, so that everyone in every department who needs to know, does know these things: what has been ordered, what has been received, what has passed inspection, what is in stock.

Inside manufacturing delays caused by lack of information, or wrong information, are eliminated. There is complete and accurate control from start of the order until stock reaches the bins.

GET FREE FOLDER FOR FULL DETAILS

As a practical means of stepping up production in your plant, get full information on this efficient new system. It's yours in the free folder, "Complete and Accurate Control over Purchased Parts and Raw Materials." Mail coupon below to A. B. Dick Company, Chicago.



MIMEOGRAPH is the trade-mark of A. B. Dick Company, Chicago, registered in the U. S. Patent Office.

Mimeograph duplicator

A. B. Dick Company, Dept. L-344
720 W. Jackson Blvd., Chicago 6.
Send me a free copy of the folder, "Complete and Accurate Control over Purchased Parts and Raw Materials."

NAME.....

COMPANY.....

CITY.....STATE.....

"This is a Grinding War . . ."

Copyright 1892 and 1920 by Harper & Bros.

MORTAR'S GRANDPA

You could pick up this U. S. mortar about as easily as you could move a safe and it was about as easy to move around. But its advocates back in the nineties foresaw the importance of such armament in modern warfare.

Today's version can be carried at a brisk trot by a couple of men. It can go into action in seconds. It's a precision weapon —precision built, facts that many a Nazi and Jap have discovered with a jolt.

Where did a lot of the modern mortar's precision come from? From a little iron-bowl furnace in which over 52 years ago, Dr. Edward Goodrich Acheson created the first man-made abrasive. Since then abrasive products have become one of our most important production tools in the skilled hands of American industry.

Abrasive wheels are used to grind the parts of mortars, plane and tank engines, giant guns and other war weapons to unbelievable accuracy.

This accuracy is responsible not only for the efficient performance of these weapons—it also makes their mass production possible.

For mass production depends on interchangeability of parts. And interchangeability depends on split-hair precision.

Today it is almost impossible to put your finger on a single article mass produced for war or for peace that isn't in some way touched by grinding. On the land, in the air, on and under the sea, material produced by abrasive manufacturing methods are blasting the path to victory for the United Nations.

We at Carborundum are mindful that "this is a grinding war." Our efforts and resources are pledged to making it as short as possible.

* * *

Every hour this war is shortened will save $12,000,000. The lives it will save are priceless. So please remember that grinding wheels, too, are "Weapons for Production". . . use them wisely to help end the war sooner.

The Carborundum Company, Niagara Falls, New York.

THE CARBORUNDUM COMPANY

CARBORUNDUM AND ALOXITE ARE REGISTERED TRADE-MARKS OF AND INDICATE MANUFACTURE BY THE CARBORUNDUM COMPANY

One proposed use for obsolete war planes is for the quick freezing of foods. Cargoes of freshly picked fruits and vegetables may be flown directly from the fields to high altitudes. There the compartments will be opened and the contents immediately frozen by the intense cold.

More than 2,000 varieties of plants have been tested for rubber during the last year.

A resin bonded panel of plywood, with a sprayed coating of steel, has eight times the strength of either material alone.

Electronic hearing devices are now so sensitive that the growing noises of a blade of grass may be heard.

One use suggested for the Helicopter is to carry girders and beams to high buildings or bridges and hold them in place while they are being fastened. This would make derricks, elevators and cranes unnecessary for this purpose.

Magnets are being used by draftsmen to hold drawings in place on steel-cored drafting boards.

Three stages of post-war development in railway locomotives are predicted. First, the high-efficiency turbine, using super-heated steam at 600 to 700 degrees. Second, the oil-burning internal combustion turbine. Third, the same type of turbine with a gas-producer using coal.

A small hand tool now "spot-welds" thermoplastic resins electronically.

So rapid are changes in technology that, for purposes of government bookkeeping, synthetic rubber plants are assumed to become obsolete in five years.

Transparent plastic, reinforced with glass fibers, is being used in aircraft construction. The material is said to have ten times the impact strength of ordinary plastics.

For twenty years people have been laughing scornfully at the "seadromes", 65,000 ton, 10 million dollar islands for transatlantic passenger planes. Now that seemingly fantastic project is being seriously considered by several large steel, shipbuilding and air transportation companies. Supported on floats 160 feet below water and extending 70 feet above the surface, the seadromes are unaffected by waves and would furnish a safe, level landing and refueling place as well as luxurious hotel accommodations.

Steel alloys, whose exact compositions are unknown, can now be quickly identified by the use of a small radio-like apparatus.

The most powerful electric motor in the world has recently been completed. It develops 7,000 horsepower at a speed of 25 r.p.m.

Seventy-two refineries are now making 100 octane gasoline, the production of which has increased 400% in the last year, and is expected to double again in the year ahead.

By the use of a new ultra-high frequency, resonator telephone engineers expect to send six-hundred thousand conversations or television pictures at one time through a six inch pipe.

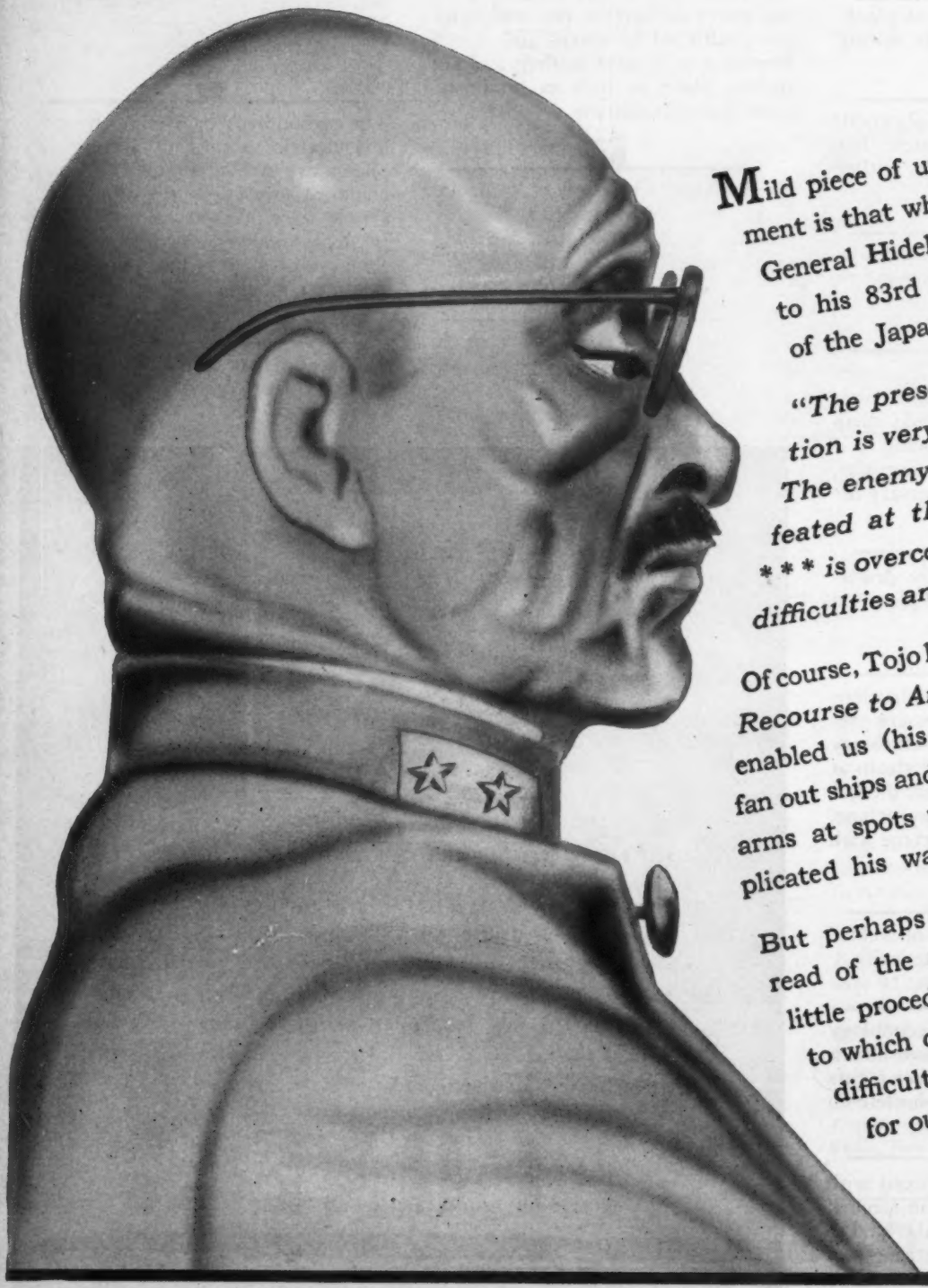
A new balance will weigh as little as two-hundred millionths of an ounce. The pointer is so tiny that it must be read through a microscope.

The carbon brushes used in the various electric motors of fighting airplanes are small, but vital. A new chemical process is reported to increase their life fifty times, and to prevent breaking down at the low temperatures in which they must operate at high altitudes.

Punched plastic sheets are now being used in place of cedar separators in storage batteries.

Then he said to himself

"VERY COMPLICATED, PLEASE"



Mild piece of understatement is that which Premier General Hideki Tojo made to his 83rd special session of the Japanese Diet:

*"The present war situation is very complicated. The enemy who was defeated at the beginning * * * is overcoming many difficulties and dangers."*

Of course, Tojo has read how *Recourse to Arc Welding* enabled us (his enemy) to fan out ships and planes and arms at spots which complicated his war situation.

But perhaps he has not read of the mountains of little procedures, recourse to which overcame many difficulties and dangers for our production men.

"OVERCOMING DIFFICULTIES AND DANGERS"—he says

Look, Tojo: How having *Recourse to Arc Welding*, the production of war tools became *very simplified* for us . . . while their effect really made your position "VERY COMPLICATED."

And think how in postwar they will make competition "Very Complicated" for a great many standpatters in production techniques.

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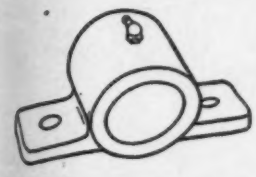
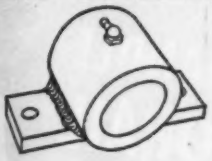
VERY COMPLICATED, PLEASE



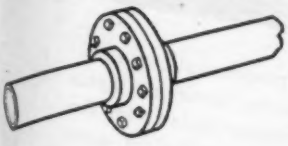
Drum shaft bearing . . .
Make pattern . . .
Mould . . .
Sand-blast . . .
(Cost in rough, $1.05)
Bore . . . Machine . . .
Drill holes.

VERY SIMPLIFIED, THANKS



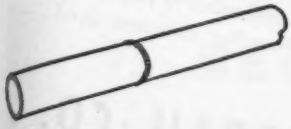
Cut strap and drill holes . .
Saw piece of tubing . . .
Arc weld into unit. . . .
Total cost $0.50.

VERY COMPLICATED, PLEASE



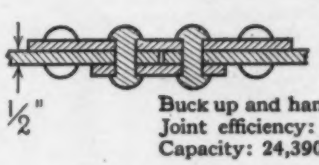
Connection in 10" steam pipe line . . .
Cut and thread ends of pipe . . .
Assemble with 2 flanges, gasket and set of bolts.
Joint requires maintenance.

VERY SIMPLIFIED, THANKS



Arc weld bevelled-end pipe . . .
A permanent, leak-proof joint.

VERY COMPLICATED, PLEASE



Structural joint requiring ½" plates . . .
Layout plates and straps accurately . . .
Drill holes accurately . . .
Put red-hot rivet in each hole . . .
Buck up and hammer down rivet heads . . .
Joint efficiency: 81.3%
Capacity: 24,390 lbs. per inch.

VERY SIMPLIFIED, THANKS

Only 7/16" plates required . . .
Bevel edge of plates . . .
Arc weld plates . . .
Joint efficiency: 100%
Capacity: 26,250 lbs. per inch.

VERY COMPLICATED, PLEASE

Axle for hay rake . . .
Make dies . . .
Forge parts . . .
Machine to fit . . .
Thread truss rod . . .
Assemble by bolting . . .
100% cost for loose-working assembly.

VERY SIMPLIFIED, THANKS

Cut angle, strap, bar and plate . . .
Arc weld into one unit . . .
70% cost for permanent assembly.

THE LINCOLN ELECTRIC COMPANY • CLEVELAND 1, OHIO

America's greatest natural **recourse**

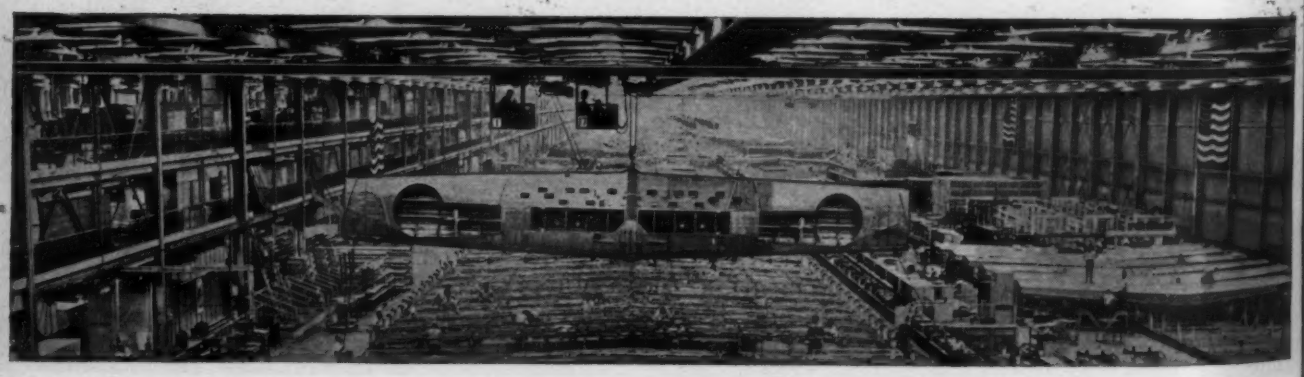
ARC WELDING

BULKY LOADS are easy to HANDLE with AMERICAN MONORAIL LONG SPAN CRANES

American MonoRail engineers solved the problems of long span multiple runway and inter-connecting cranes, furnishing plants of mammoth size with overhead transportation systems for the movement of massive loads. These remarkable installations, some equipped with over thirty miles of runway, may mean little to the average plant, but the tricks our engineers learned and their ability to solve such problems may be of real value to you. It will pay you to consult with the American MonoRail Engineer. Send for copy of book C-1.

Photos courtesy of
The Austin Co.
Cleveland, Ohio

● THE AMERICAN MONORAIL CO.
13114 ATHENS AVENUE CLEVELAND 7, OHIO



"Turning Points" to Victory

BEACHHEAD BRAWL-BUGGY

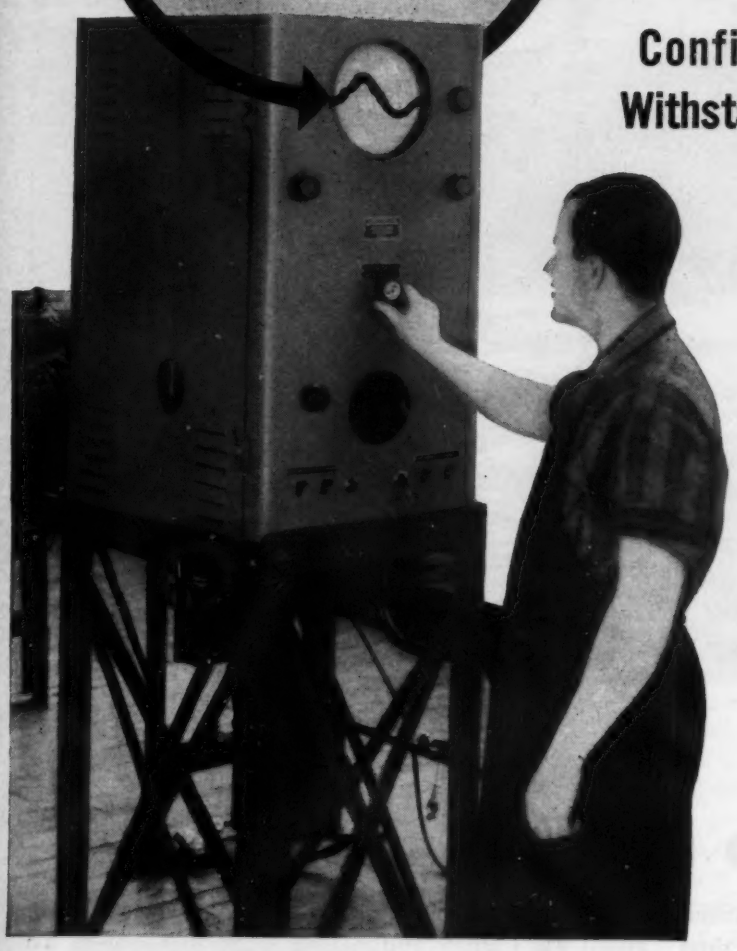
The very essence of sea-borne invasion is the amphibious troop carrier that literally wades into the enemy and "slugs it out" in typical American fashion. Engineering magic enables this versatile vehicle to drive itself from ship to shore, secure a four-wheeled foothold and deepen the beachhead for safe debarkation of more men, munitions and supplies. It is often the turning point of invasion success – and its own "turning points" are ball bearings.

Amphibious vehicles have hazards other than bombs and bullets. Mechanically, they must resist the corrosion of sea water, the abrasion of sand, and the whole range of global war's temperatures from Arctic to Equator. To meet these conditions, Fafnir Ball Bearings are engineered to resist trouble while they deliver smooth, dependable performance in vital parts of practically every type of war machine.

They will be just as carefully engineered to serve in untold numbers of applications and deliver friction-free performance in coming peacetime products. The Fafnir Bearing Company, New Britain, Connecticut.

FAFNIR BALL BEARINGS

new... ELECTRONIC



Confirms Ability of Insulation to Withstand Shorts Due to Voltage Surges

● Now, a new electronic test shows visually that the insulation of every coil, every turn, and every phase of a G-E Tri-Clad motor winding has the strength to withstand the voltage surges that are a cause of shorts and grounds in service. Thanks to this new G-E development, no undisclosed insulation weakness can "get by."

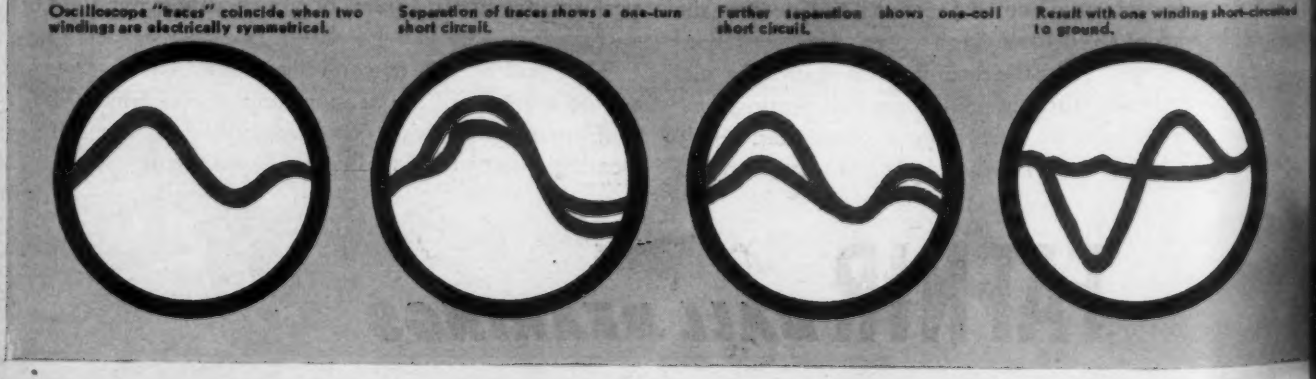
The new test method* subjects each coil in the assembled motor to a steep-front surge impulse, similar to a high-voltage transient of actual service. A cathode-ray oscilloscope indicates the performance of the winding under this sudden stress.

Only a motor with perfect insulation, and with the phases symmetrical, will give a single, clear-cut "standing wave" on the screen. The test indicates not only the condition of turn-to-turn insulation, but also that of coil-to-coil and coil-to-ground insulation.

This test is now applied to all G-E Tri-Clad motors, and to many other G-E motors and generators, as a regular step in production. Its advantages are so great that its use is widening throughout the motor industry.

*For complete details, see "Insulation Testing of Electric Windings," Trans. of A.I.E.E., Vol. 62, pp. 203-206.

HERE'S HOW WINDING STRENGTH SHOWS UP ON THE OSCILLOSCOPE "WINDOW"


Oscilloscope "traces" coincide when two windings are electrically symmetrical.
Separation of traces shows a one-turn short circuit.
Further separation shows one-coil short circuit.
Result with one winding short-circuited to ground.

TEST Tells the "Inside Story" of Motor Windings

Production-line test of G-E Tri-Clad motors with new electronic tester. Operator turns transfer switch to take reading on each phase.

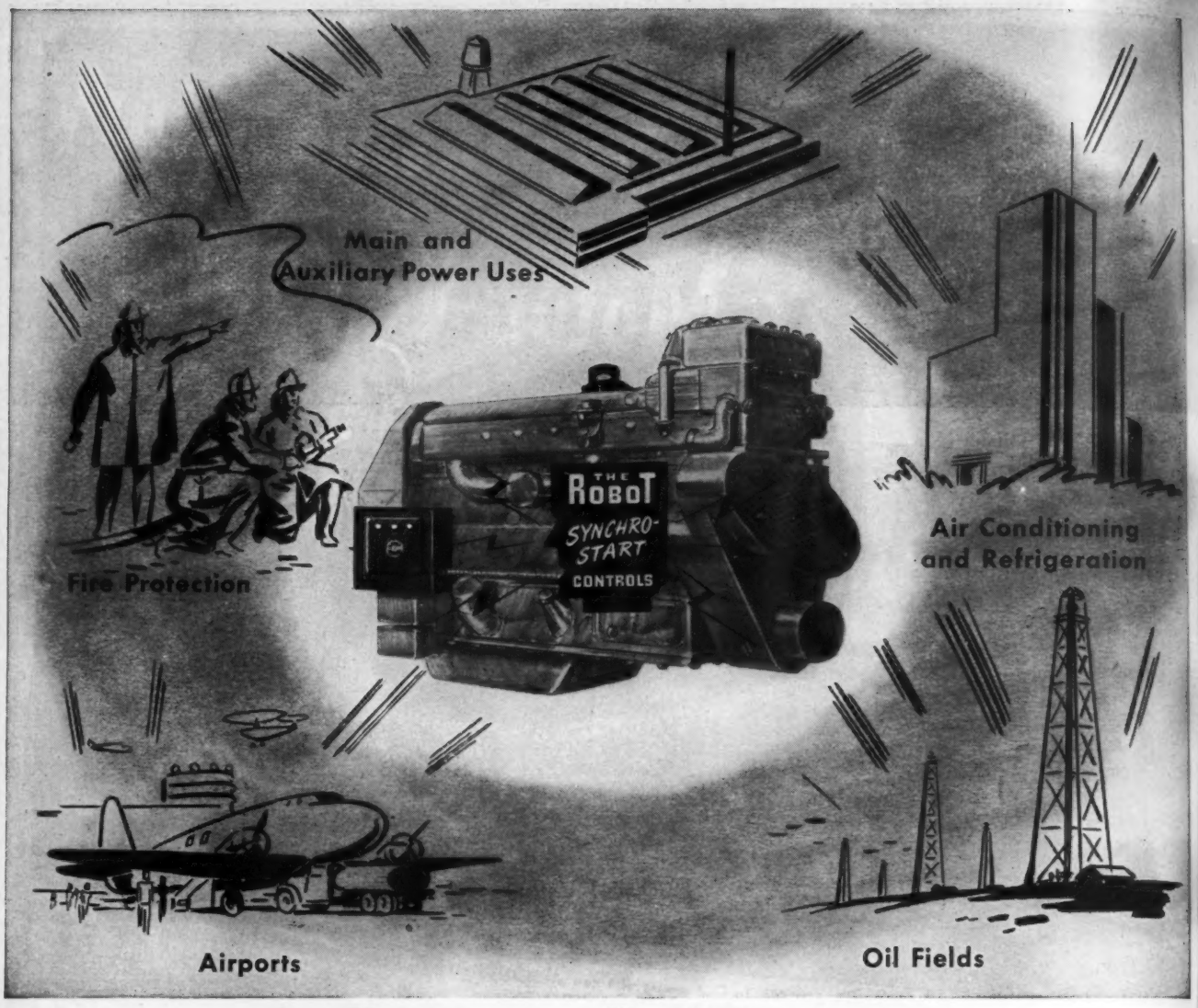
An Individual Check of Each TRI CLAD Motor Gives Extra Assurance of Unfailing Service

At each Tri-Clad motor factory, a production-line test setup like the one shown above is regularly in service. The motor windings are checked by this new test as an *additional* step in G.E.'s strict testing procedure. Other winding tests include the high-potential and high-frequency tests, in addition to many quality tests made on Formex* wire and other winding materials before they are used in the motor windings. Whenever you buy or specify a G-E Tri-Clad motor for your plant or machine, you get extra assurance of unfailing service. *General Electric Company, Schenectady, N. Y.*

*Reg. U. S. Pat. Office.

Every week 192,000 G-E employees buy more than a million dollars' worth of War Bonds.

GENERAL ELECTRIC



Automatically Controlled Engines Will Solve YOUR Power Problems

● An internal combustion engine with SYNCHRO-START CONTROLS opens up new horizons in the production of safe, flexible, dependable power for a wide variety of uses.

● During the past 10 years the demand for SYNCHRO-START CONTROLLED ENGINES has grown tremendously due to the success with which they have replaced less modern methods of power production.

● Practically all leading engine manufacturers can furnish you with complete information on SYNCHRO-START Automatically Controlled Engines.

● Consult your engine manufacturer or write direct to us.

SYNCHRO-START PRODUCTS, INC.

221 EAST CULLERTON ST. **CHICAGO, ILLINOIS**

SYNCHRO-START *AUTOMATIC ENGINE* **CONTROLS**

THE SPEED REDUCER *that Mounts on the Shaft!*

Only American Reduction Drives Give You These Advantages:

Easy to Obtain

Available in six standard stock sizes to fit jobs from ¼ to 25 H.P.—American Reduction Drives are bought "off-the-shelf" from a catalog just like any tool.

Easy to Install

The Reduction Unit mounts directly on the shaft of the driven machine—as quickly and simply as a pulley. Since no expensive drive supports or foundations are needed, it is exceptionally economical.

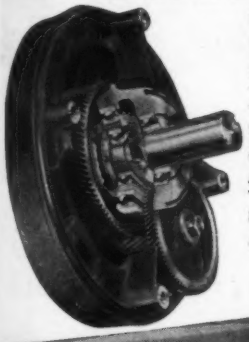
Space Saving

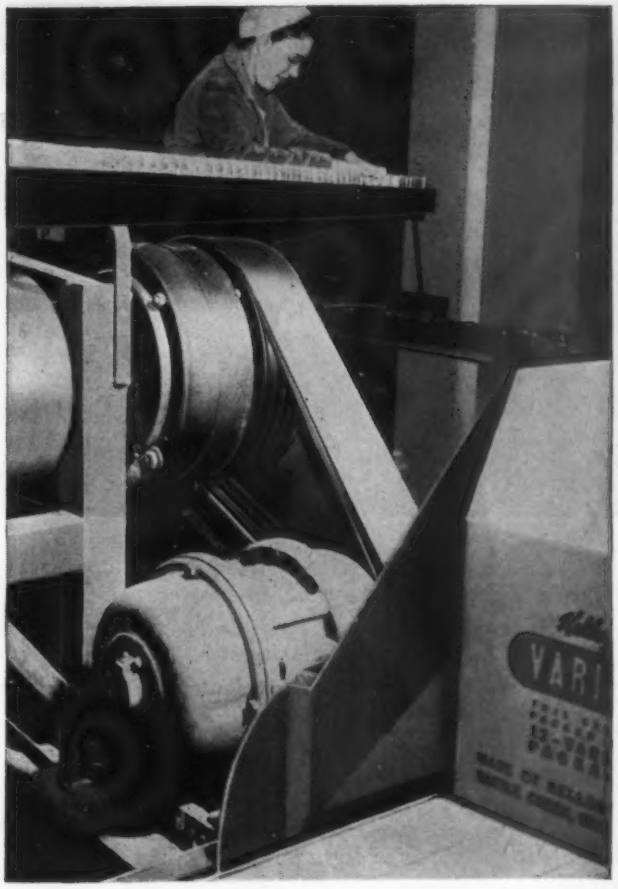
Its compact design—its "mounts-on-the-shaft" feature—make the American Reduction Drive unique in the field of modern speed reducers.

Top Efficiency UNDER 154 R.P.M.

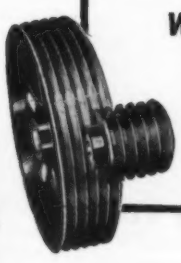
Frictional losses are never over 1½%—considerably lower than ordinary gear assemblies.

By merely changing pulley or sheave sizes in the primary drive, any speed you need between 11 and 154 R.P.M. is accurately delivered by the unit's standard 13-to-1 ratio. *Any* motor can be used. Maintenance is no problem because the *belt* absorbs the impact of shock loads and acts as a "cushion" to save motor and gear wear. Get all these exclusive benefits by equipping your slow-speed machines with American Reduction Drives.





Kellogg benefits through American Reduction Drive's exclusive advantages. The Kellogg Company—makers of cereal foods—operate this conveyor at a speed of 20 R.P.M.—driven by a 1200 R.P.M. motor through an American Reduction Drive. The standard 13-to-1 ratio of the Reduction Unit makes it easy to get the desired driven speed by simply selecting the necessary sheave sizes in the primary drive. Compactness and ease of mounting on the shaft of the driven machine make the American Reduction Drive unique.



WEDGBELT SHEAVES

American Wedgbelt Sheaves are made to the highest precision standards. They are made of sound, strong metal, accurately machined, finely finished and carefully balanced.

The American Pulley Company

4210 WISSAHICKON AVE., PHILADELPHIA 29, PA.

DO IT FASTER WITH Thor

• Thor Portable Electric Tools combine compact power with light weight to do scores of jobs *faster.*

For example—Thor *reduced the weight* of ¼-inch electric drills 14 percent with plastic housings.

Thor *increased the power* of electric hammers with a patented "sling-shot" drive.

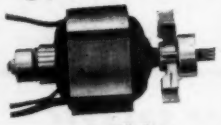
Thor introduced *compact power* with the original, close-coupled half-inch electric drill.

The features of greater power with easier handling combine to give you *more efficient performance* with Thor Portable Electric Tools for all types of light and heavy duty drilling, screwdriving, reaming, nut setting, tapping, grinding, sanding, polishing, sawing, metal cutting and hammering.

STAR DRILLING like this is fast and sure with the Thor Portable Electric Hammer—for drilling and hammering in stone, wood or metal.

SANDING and finishing preparatory to painting, with an easy-handling Thor Electric Sander, perfectly balanced for efficient operation.

OUTSTANDING THOR FEATURES OF DESIGN AND CONSTRUCTION



Thor Motor

THOR MOTORS are fabricated of the highest grade materials, with armatures carefully wound and insulated to withstand heat and vibration. Commutators are assembled with special care to avoid floating segments or raised bars.

Thor Gears

THOR GEARS are made of heat treated alloy steel with oversize pitch to assure smooth operation and longer life.

Thor Bearings

THOR VENTILATION of the tangential type provides 25% greater cooling capacity.

THOR BEARINGS of the highest grade, are mounted in cast-in steel inserts and diamond bored to assure perfect alignment.

NEW HELP FOR YOU IN SELECTING ELECTRIC TOOLS

Just off the press, the latest edition of Thor Portable Electric Tool Catalog is packed full of information on the selection of proper tools for your work. 64 pages of complete specifications, performance data, construction features . . . arranged for quick and easy reference and fully illustrated.

PORTABLE ELECTRIC TOOLS

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ASSEMBLING parachute flares with Thor Portable Electric Screwdrivers, light weight favorites of women operators.

SETTING NUTS with a large capacity, heavy duty Thor Electric Nut Setter, easy to handle . . . insuring quick, certain operation.

GRINDING down a weld with a Thor Portable Electric Grinder saves handling time by bringing the tool to the work—instead of the work to the tool.

DRILLING with the Thor original close-coupled half-inch portable electric drill, compactly built for fast work on heavy jobs.

Thor *Portable Electric Tools*

INDEPENDENT PNEUMATIC TOOL COMPANY

600 W. JACKSON BOULEVARD, CHICAGO, ILL.

Branches in Principal Cities

PATRONIZE YOUR DISTRIBUTOR

Thor Portable Electric Tools are stocked and sold by leading electrical, automotive, mill supply, plumbing and hardware distributors throughout the world. This guarantees you quick, convenient, reliable service. Write for name of distributor nearest you.

Will it just "do," or...will it "DO THE JOB"

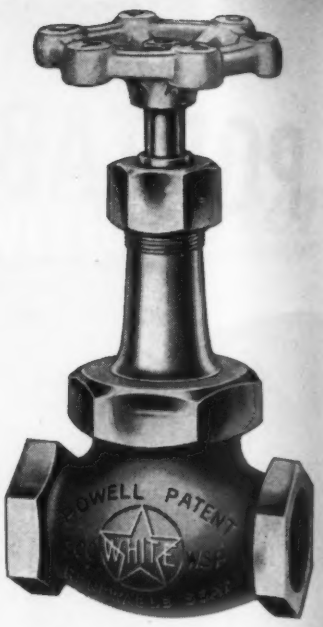


Fig. 1708—Bronze Globe Valve for 200 pounds W.P. Has screwed ends, union bonnet, renewable seat and regrindable, renewable hard bronze semi-cone plug type disc. This valve is especially suitable for throttling service.

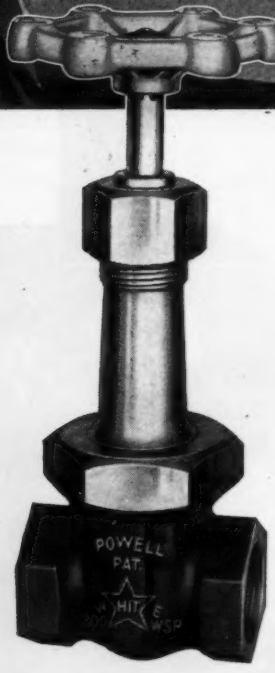


Fig. 375—Bronze Gate Valve for 200 pounds W.P. Has screwed ends, union bonnet, inside screw rising stem and a special hard bronze disc.

"There is a valve that will *"do"*—or "there is a POWELL Valve that will *do the job"*—what a vital difference in meaning.

But as long as you have POWELL Engineering at your service, you'll never have to make a valve "do"—because POWELL not only has a complete line of standard valves as listed in our general catalog but—POWELL Engineering is ready at all times to offer *specialized* service.

Shown here are three of POWELL'S complete line of Bronze Valves. These valves are correctly engineered in every detail for controlling the flow of low-pressure steam, oil, water or gas.

The Wm. Powell Co.

Dependable Valves Since 1846

Cincinnati 22, Ohio

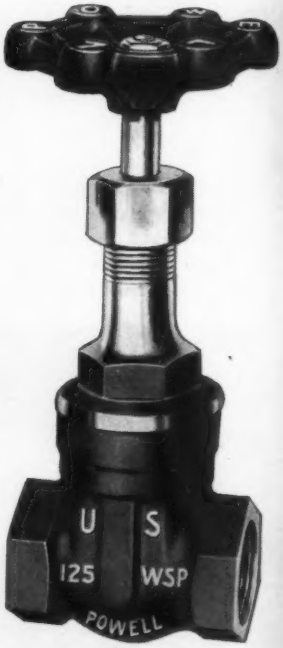
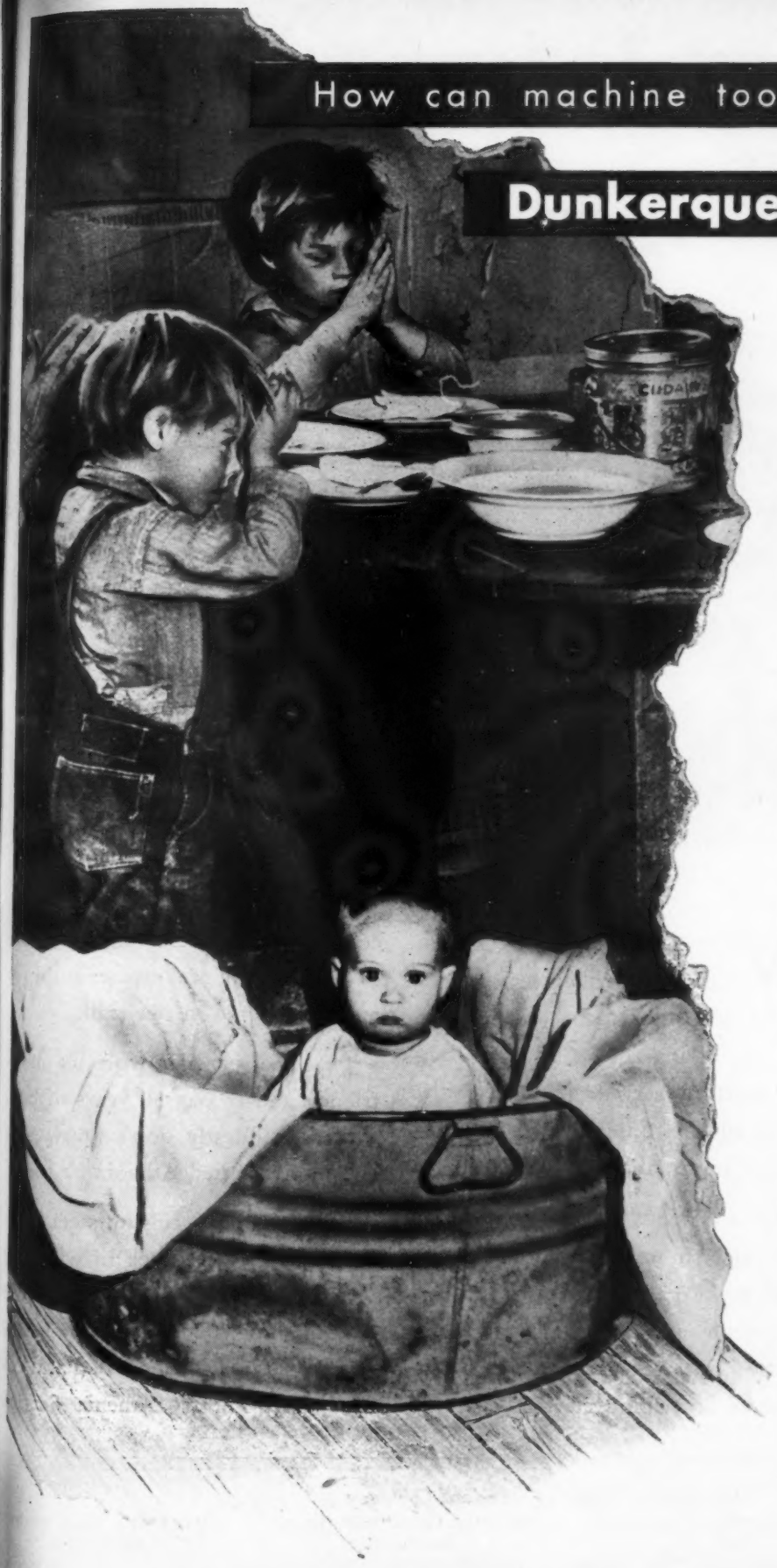


Fig. 500—Bronze Gate Valve for 125 pounds W.P. Has screwed ends, screwed-in bonnet and inside screw rising stem. Sizes ¼" to ¾" are equipped with taper wedge solid disc; sizes 1" to 3" with taper wedge double disc.

POWELL VALVES



How can machine tools avenge this

Dunkerque in America?

This is no enemy propaganda. No "usually well-informed sources" or Berlin broadcasts tell this tale. This is real . . . this is here . . . and this is defeat.

Our own private *peacetime* Dunkerque — in Arkansas, in New York, in West Virginia or California — in countless American "homes" where millions of people are ill-housed, ill-clothed, and bodily and mentally ill-fed.

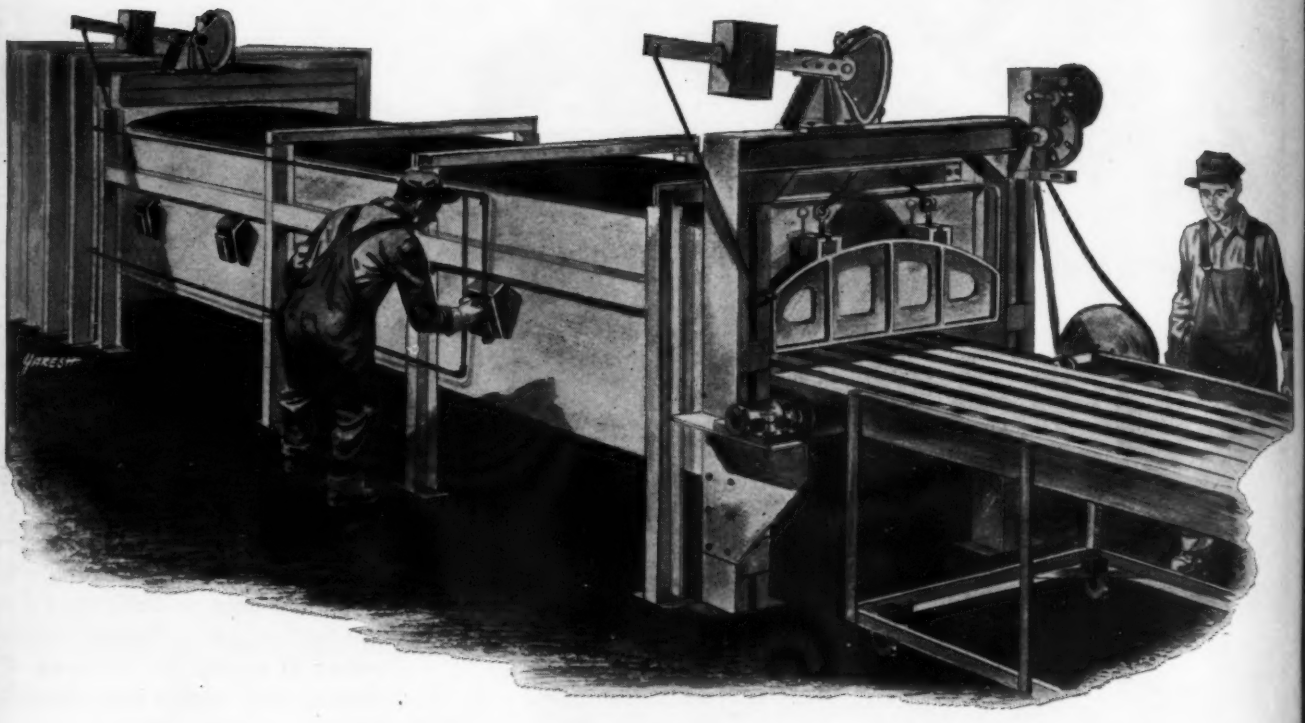
What part will machine tools play in turning this kind of defeat into victory? The *whole* part, if the men of industry have the vision and the freedom to plan ahead, and to carry out what they plan.

If you are a manufacturer, there is one thing you can do at once: Have your production men and planners consult now with the engineers of the leading basic machine tool producers. They can help you in planning today your part in the peace that must be won after the war is won.

One of these is a Bryant man. . . . We invite you to send for him.

BRYANT CHUCKING GRINDER COMPANY SPRINGFIELD VERMONT, U. S. A.

The Steel that makes watches tick—and Corsets fit snugger



WATCH springs and corset stays are rarely seen by the person who uses them, and neither are piston rings or bomb fuses. But the function served by those little parts in the finished product, *is* mighty important to the user.

Athenia Steel Company has always specialized in producing high-carbon steel for exacting purposes. It has meant the sacrifice of volume production, in favor of the old Swedish method of making steel in smaller, controllable batches. It has meant the development of real craftsmanship in every employee in our mill.

That policy has won us many friends, and in our 30 years of business we honestly don't know of a single dissatisfied Athenia customer.

If you have a precision steel problem that involves stock in widths of 1/16" to 6½", thicknesses of .0015 to .062—annealed, cold rolled, tempered, or tempered polished and colored—why not try Athenia Service?

ATHENIA STEEL Company

Divisions of National-Standard Company

ATHENIA STEEL
Clifton, N. J.
COLD ROLLED, HIGH-CARBON SPRING STEEL

NATIONAL-STANDARD
Niles, Mich.
TIRE WIRE, FABRICATED BRAIDS AND TAPE

WAGNER LITHO MACHINERY
Hoboken, N. J.
LITHOGRAPHING AND SPECIAL MACHINERY

WORCESTER WIRE WORKS
Worcester, Mass.
ROUND STEEL WIRE, SMALL SIZES

Look how SIMPLE

THERE'S NEVER ANY CONTACT MAINTENANCE

Omaha Public Library
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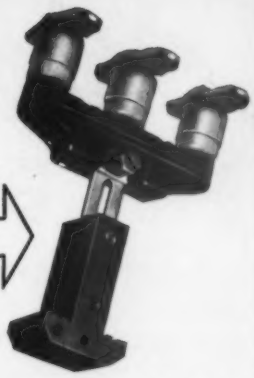
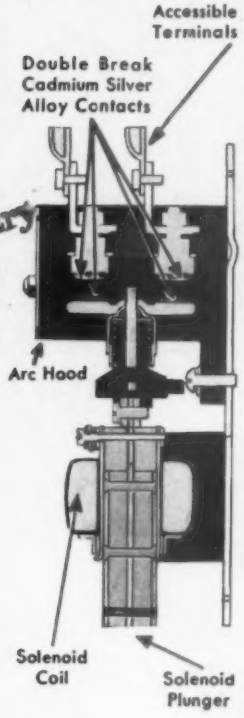
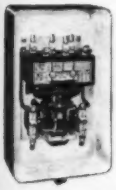


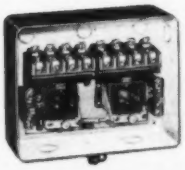
Allen-Bradley Double Break, Silver Alloy Contacts need no attention—no dressing, cleaning, or filing.



Arc hood enclosing the contacts permits unusually compact construction with plenty of wiring space at top, bottom, and sides. Completely removable cover, plenty of knockouts in sides and back, and white interior make installation easy.



Automatic



Reversing

Multispeed

Combination

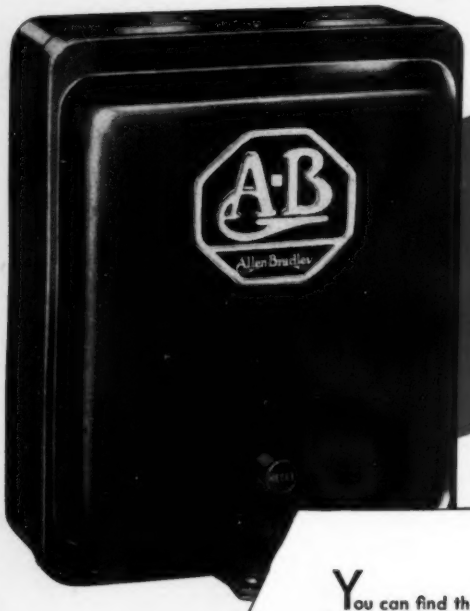
Allen-Bradley solenoid starters never require any contact maintenance because any oxide which may form in the switching operation is a good conductor. There are no pins, pivots, bearings, hinges, or flexible jumpers to gum up, stick, or corrode. A-B starters are good for millions of trouble-free operations. You install 'em . . . then forget 'em. Send for Bulletin 709.

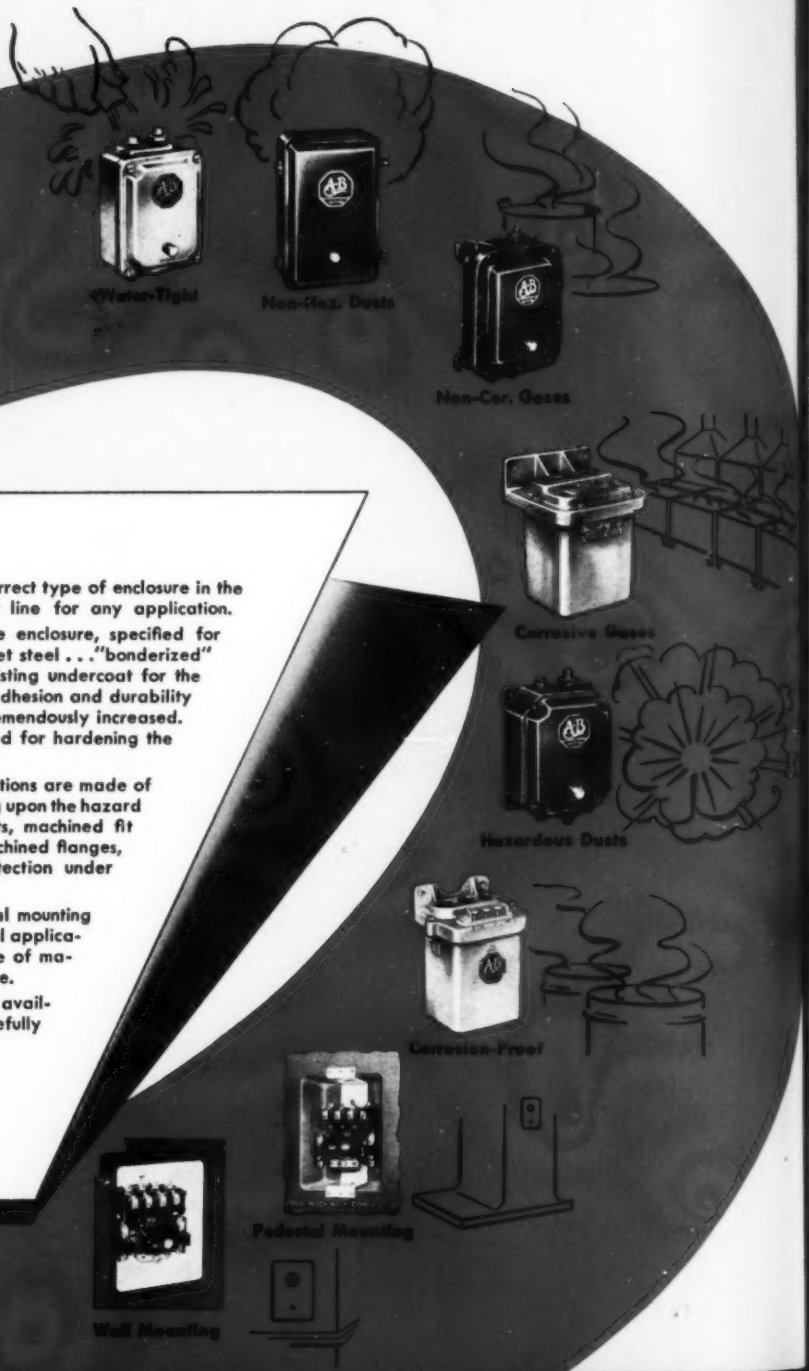
ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

Motor Starter Enclosures...
For Every Type of Service





You can find the correct type of enclosure in the Allen-Bradley starter line for any application.

The general-purpose enclosure, specified for most installations, is sheet steel . . . "bonderized" . . . to provide a rust-resisting undercoat for the baked enamel finish. The adhesion and durability of the enamel surface is tremendously increased. Infra-red lamp ovens are used for hardening the enamel top coat.

Enclosures for special applications are made of cast iron or sheet steel, depending upon the hazard encountered. Live rubber gaskets, machined fit between cover and base, wide machined flanges, or bolted covers provide full protection under various service conditions.

The two models for wall or pedestal mounting were designed specially for machine tool applications. They help improve the appearance of machine tools by making streamlining possible.

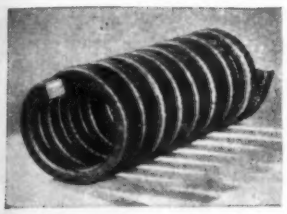
Contactors, relays, pilot controls, etc., are available in the same safe, practical, and carefully engineered enclosures.

ALLEN-BRADLEY COMPANY
1316 S. Second St.
Milwaukee 4, Wis.

A-B Quality

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

Win the War in Forty-Four!



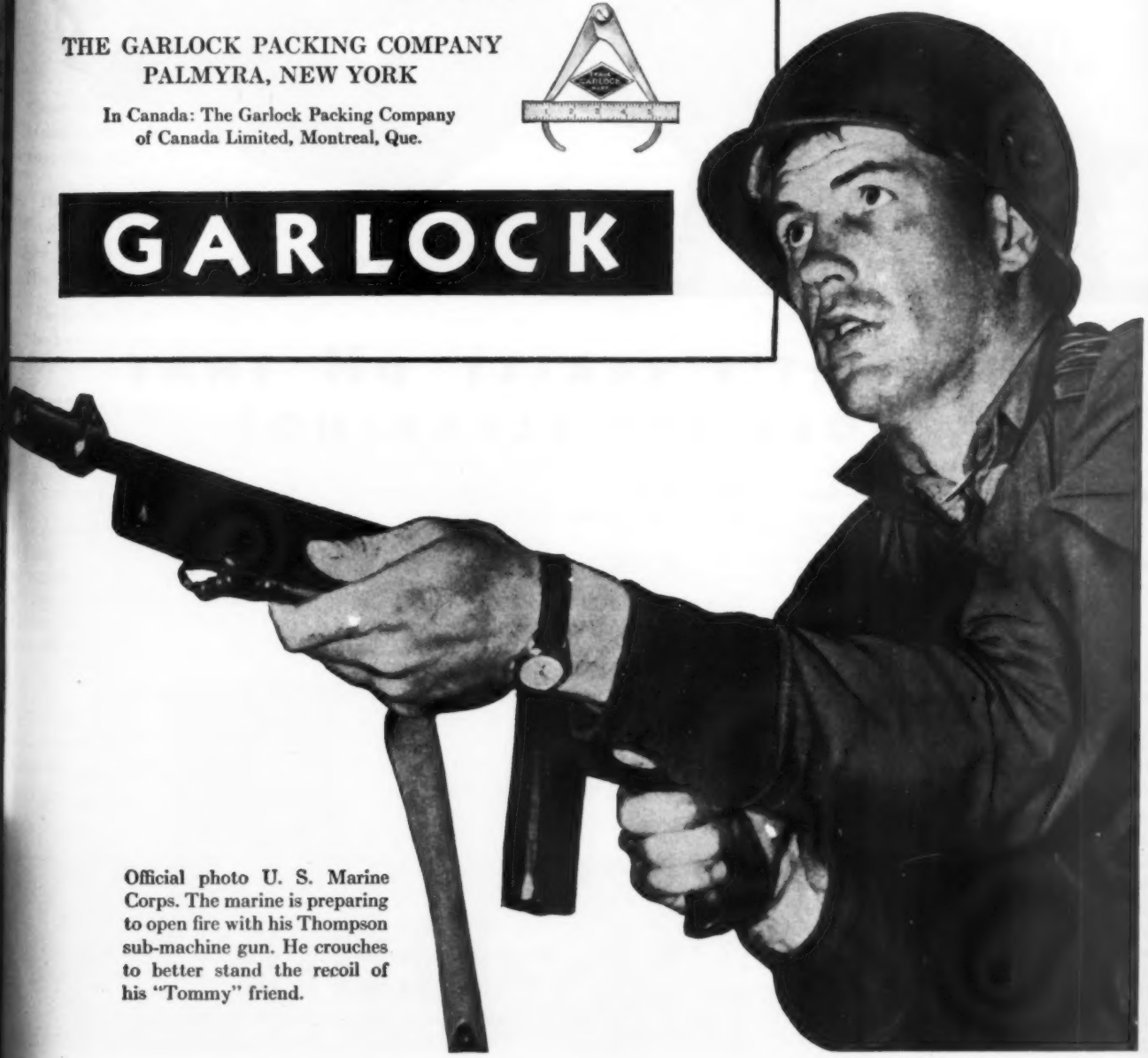
GARLOCK 150 Rod Packing for High Pressure Steam (Spiral form). Coil form—GARLOCK 125. Ring form—GARLOCK 200.

Every day we are producing tons of GARLOCK Packings, Gaskets and KLOZURE Oil Seals for the U.S. Armed Forces and War Industries. Their dependable performance will help the effort of the United Nations to *win the war in '44*. Essential civilian industries are also being supplied with GARLOCK products to the limit of our capacity.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK

In Canada: The Garlock Packing Company of Canada Limited, Montreal, Que.

GARLOCK



Official photo U. S. Marine Corps. The marine is preparing to open fire with his Thompson sub-machine gun. He crouches to better stand the recoil of his "Tommy" friend.

NO...IT'S REALLY pH THAT DOES THE CLEANING!

THE "CURE-ALL" is a great idea—but it won't work. Today, in your business and in ours, we know that it takes a "specific" to make a cure or get a job done right.

One Does The Work Best

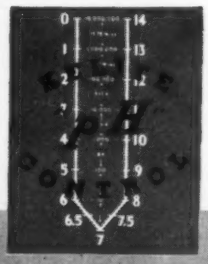
In every processing and cleaning operation there is one specific chemical combination which precisely fills the requirements of a particular situation and will do the job best. The difference between this correct material and anything else — even the closest approximation—is extreme. Kelite sees it every day in reports from Service Engineers in the field. You can see it in the unequalled speed, certainty and economy which the correct material makes possible.

pH Simplifies The Job

This matter of the right material for the job is so important that Kelite has gone to great lengths to attain it. Formerly, standardized test tubes of correct solutions were made up in the laboratory and used as models on the job. All this work was worth while, but it was slow... until we learned how to make use of pH. Now it's simple!

No Special Skill Needed

An operator does not have to be skilled to use Kelite pH Control. The pH values are lined up and compared in an easily-understandable form on the Kelite pH Chart. It's as easy to use as a yardstick! Your inquiry is invited.



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Kelite Products, Inc.
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Los Angeles 1, Calif.

Manufacturing Plants in LOS ANGELES, CHICAGO, PERTH AMBOY, HOUSTON
Branches in Principal Cities.

KELITE

INDUSTRIAL CHEMICAL PROCESSES AND MATERIALS

Re-conversion *will not be a serious problem with us*

LIKE MOST other manufacturers, we have had to strain our facilities to the utmost to supply the demands of the present emergency. While some of the products we are producing for war purposes are "special," much standard (FA) Electrical Equipment has fitted perfectly into the war picture. And, where priorities permit, we are still manufacturing for non-war use. . . . At the same time, we have found it possible to continue with the development of new products. . . . So, when Victory comes, we will be able to turn at once to the production of equipment for industrial, commercial and residential use.

Among the new (FA) Products now available are

KLAMPSWITCHFUZ SWITCHBOARDS

These are assembled of standard units of similar or varied capacities, in either Dead Front or Safety Type Switchboards.

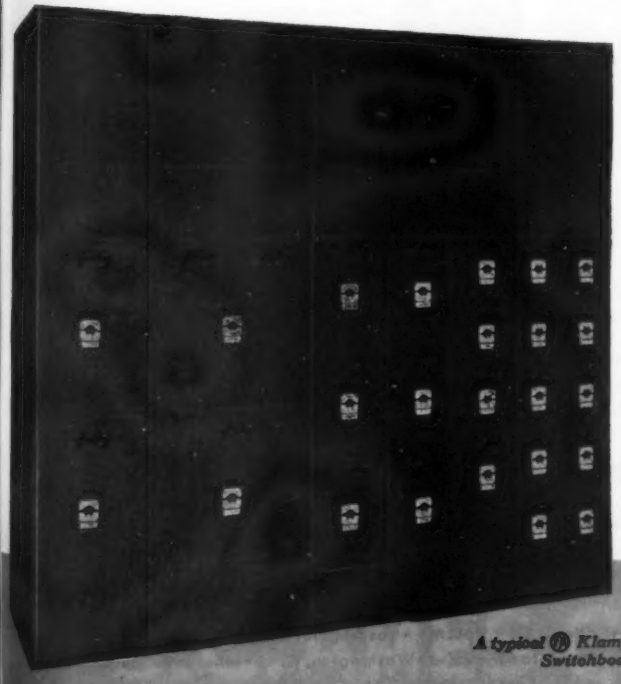
The face appearance of both is identical. The Dead Front type is open at the rear, which requires a protective grill to prevent access to current-carrying parts. The Safety Type is equipped with steel doors at the rear.

Each (FA) Klampswitchfuz unit is of the hinged type. The basic design is that of the knife switch—that is, the insertion of a blade into a contact clip. In the ON position the switch blades make *pressure contact* with the slots in the base, and are thus drawn tightly together at the fuse contacts. This, with the silver-plated contact parts, assures low-resistance to current flow.

Switch and fuse are combined in one unit, so that accidental contact with live parts is impossible when the door is closed.

(FA) Klampswitchfuz units are made in capacities of 30 to 1800 amperes, inclusive, 250 volts AC and DC, and 30 to 600 amperes, inclusive, 575 volts AC, in 2, 3 and 4 pole types, single and double throw. They are approved by Underwriters' Laboratories, Inc., as operating switches for 600 amperes and less, 250 volts AC and DC, and 200 amperes and less, 575 volts AC. All other capacities are approved as disconnect switches only.

(FA) Klampswitchfuz Switchboards are completely assembled at the factory, and shipped ready for connection of main feeder and branch circuit cables.



A typical (FA) Klampswitchfuz Switchboard

For the latest Engineering Data on (FA) Switchboards consult an (FA) Sales-Engineer. By long experience, he is competent to help Architects, Engineers and Specification Writers in problems of designing and specifying electrical installations. Write for name and address of the one nearest you. No obligation . . . Frank Adam Electric Co., Box 357, St. Louis, Mo.

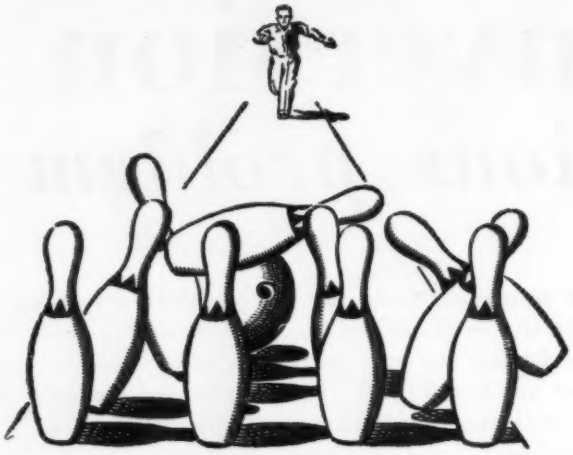
ESTABLISHED 1891 — THE SIGN OF A BETTER JOB

Frank Adam

ELECTRICAL PRODUCTS

for War Industry

FRANK ADAM ELECTRIC CO. ST. LOUIS, MO. U.S.A.

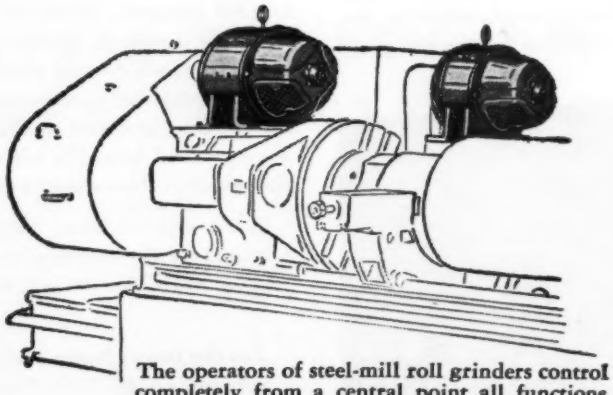


CONTROL!

Electric motor-drive, properly applied, can be used not only to supply power but to *control* a wide variety of production operations—*electrically* rather than mechanically. The results, in improved speed and quality of work, simplified design and reduced costs are frequently remarkable.

This control is accomplished through characteristics that are inherent in Reliance Electric Motor-Drive. Starting, acceleration and speed changes are simply and effectively controlled, automatic reversal can be provided at any desired point in a cycle of operations, tension can be properly and constantly maintained in the processing of such materials as metals, paper and cloth.

The "know how" which enables Reliance men to offer constructive help in working out improvements in machine design or production processes comes from applying electric motor-drive in many ways in many industries. It will pay you to take advantage of their experience.



The operators of steel-mill roll grinders control completely from a central point all functions of their huge machines, many of which are powered by as many as 9 Reliance Motors.

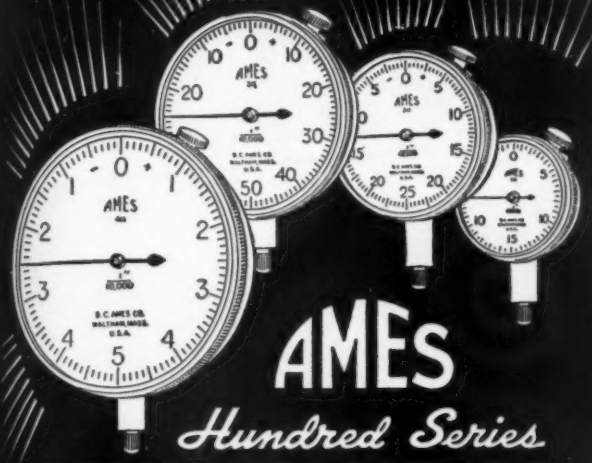
RELIANCE A·C D·C MOTORS

RELIANCE ELECTRIC & ENGINEERING CO.

1088 Ivanhoe Road • Cleveland, Ohio

Birmingham • Boston • Buffalo • Chicago • Cincinnati • Detroit • Greenville (S.C.) • Houston • Los Angeles • Minneapolis • New York Philadelphia • Pittsburgh • Portland (Ore.) • St. Louis • Salt Lake City • San Francisco • Syracuse • Washington, D. C. • other principal cities.

4 Sizes ~ 14 Dial Faces



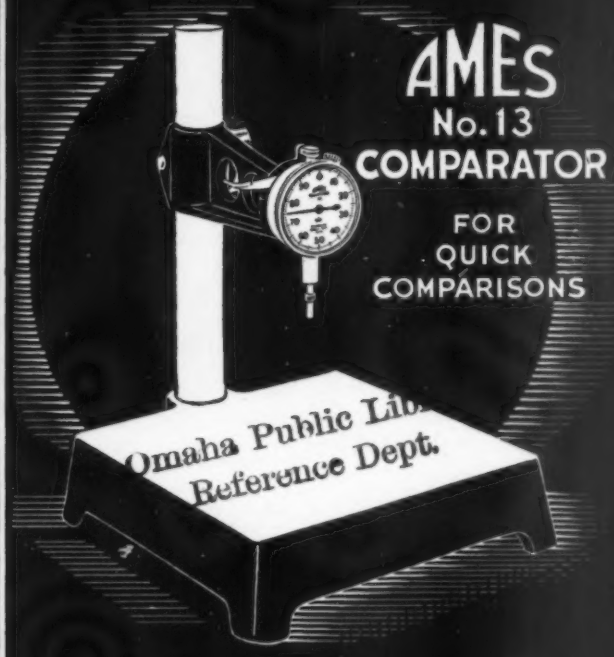
AMES
Hundred Series
DIAL INDICATORS

In four sizes with fourteen different dial graduations, indicating thousandths, half-thousandths or tenths of thousandths inches.

Speedy, accurate, inexpensive and adaptable to various measuring and testing jobs.

Write today for catalog.

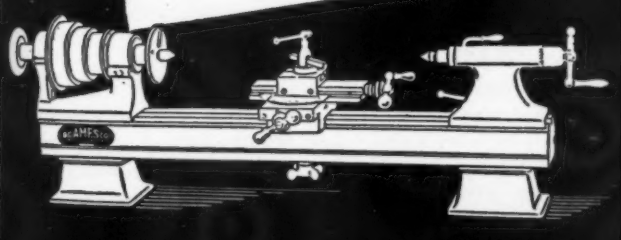
FAST • ACCURATE



AMES
No. 13
COMPARATOR
FOR
QUICK
COMPARISONS

AMES Precision BENCH LATHE

Known for 40 years as a precision lathe of the highest quality. Bed 36" long. Ball bearing headstock uses 1" capacity collets. Swing 8 3/8" over bed. Available with motor drive.
Send For Catalog

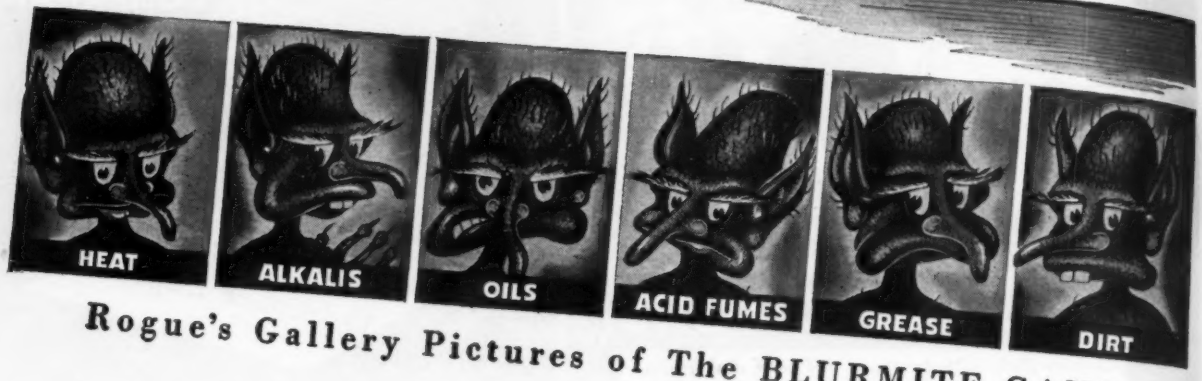


Shockless
in
Four Sizes

AMES
Hundred Series
DIAL INDICATORS

B.C. AMES CO. WALTHAM, MASS.

REWARD



Rogue's Gallery Pictures of The BLURMITE GANG

Plastic-Finished Marlite Offers Rewards

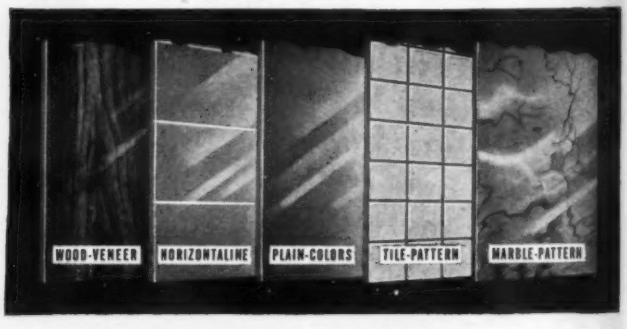
in *Improved Employee Morale* and *Increased Production*

By providing employees with adequate and modern health-comfort facilities — toilets, restrooms, locker rooms, dispensaries, first-aid stations, cafeterias, etc.—progressive industrials are reaping excellent rewards in improved employee morale and increased production . . . especially when plastic-finished Marlite is the interior surfacing material used.

Why Marlite? Because Marlite's exclusive *high-heat-bake* finish guarantees the installation to retain its original beauty and luster over the years. All interior wall, ceiling and counter surfaces are constantly subjected to the destructive action of Blurmites and Marlite guarantees the surfaces to be permanently sealed against the deteriorating effects of Blurmites . . . sealed to prevent dirt and moisture penetration. In addition, Marlite offers easy installation and extra low maintenance time and cost.

WPB Makes More Materials Available

Evidence of the importance of health-comfort facilities is substantiated by a recent order to WPB in which President Roosevelt directed Chairman Nelson "to make the necessary materials available for such facilities"—toilets, restrooms, locker rooms, dispensaries, cafeterias, etc.



MARLITE Selections and Deliveries

Plastic-finished Marlite is manufactured in a wide choice of colors and patterns. Marlite is *immediately available* on suitable priorities for today's jobs. A free, full-color catalog is yours on request and remember, Marsh Engineers are ready to help with plans and specifications. Write today!

Marlite

REG. U. S. PAT. OFF.

MARSH WALL PRODUCTS, Inc.

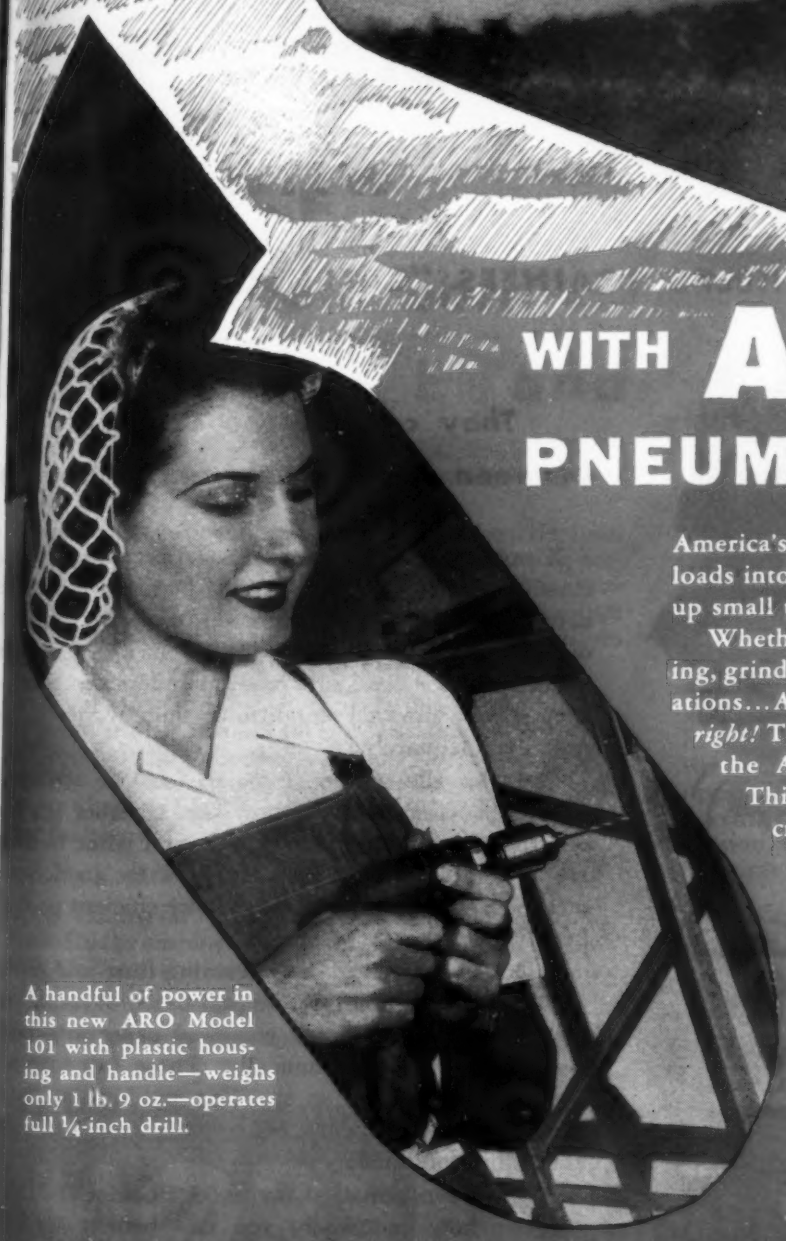
350 MAIN ST., DOVER, OHIO

PLASTIC-FINISHED WALL PANELS • FOR CREATING *duty-ful* BEAUTIFUL INTERIORS

SPEED THE ATTACK

WITH ARO PNEUMATIC TOOLS

America's production lines can send more bomb-loads into Nazi-land and Jap-land...by speeding up small tool jobs with ARO Pneumatic Tools! Whether it's drilling, nut-setting, screw-driving, grinding or countless other small tool operations...ARO Pneumatic Tools get the job done *right!* Though small in size and light in weight, the ARO Tools pack tremendous power. This means faster production, greater efficiency, less fatigue—ideal for women! ARO Tools are *tops* for rugged . . . dependable . . . stall-proof operation. Write for your catalog today. . . The Aro Equipment Corporation, Bryan, Ohio.



A handful of power in this new ARO Model 101 with plastic housing and handle—weighs only 1 lb. 9 oz.—operates full ¼-inch drill.

THE ARO EQUIP. CORP. PNEUMATIC ARO TOOLS BRYAN, OHIO

A. Good weldment.
B. Poor weldment. Note poor penetration and slag inclusions.
C. Good weldment.
D. Poor weldment. Note gas pockets.

looking inside WITH X-RAY

HELPS TRAINEES "CATCH ON" QUICKER!

They can SEE the difference between a good weld and a bad one

X-ray rules out guesswork in training, qualifying or classifying welders—or other workers—according to actual ability. It puts these all-important functions on a factual basis. For radiographs clarify . . . provide absolute proof . . . are readily understood because they *show* internal conditions that words fail to describe adequately.

They let the worker *look inside* the weldment, casting or assembly . . . show him whether it's good or bad . . . show him what to do and what to avoid. He "catches on" quicker, adheres to good, sound methods, and becomes a faster, more efficient producer from the start.

In addition to shortening training time and putting worker-classification on a factual basis, Westinghouse Industrial X-ray is doing countless other jobs faster, better and more economically. These fall into such major classifications as speeding production, saving machine and man-hours, conserving critical materials and improving quality.

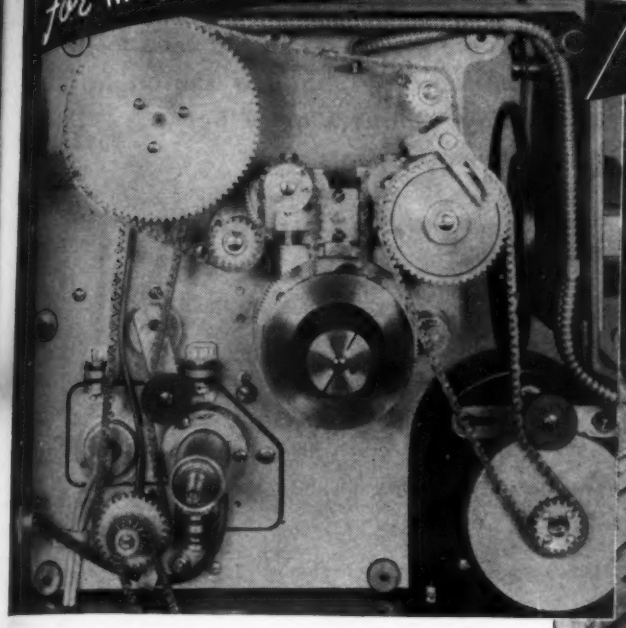
For more information, write for Booklet B-3159. It suggests how and where you can benefit by using industrial x-ray. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-02025

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

Industrial **X-RAY**

For MOTION PICTURE PROJECTORS and 30 ton MACK TRUCKS



MORSE makes them both MINUTE and MIGHTY

Movies would flicker, the strong, silent movie hero would threaten the villain with his hands flickering nervously, instead of with calm assurance—all performers would jerkily hop about—if film was passed through projectors at an uneven rate of speed, if slipping drives were used to turn the spools of film projectors.

With minute Morse 3/16" pitch chain on the job, however, film spools are turned smoothly and silently, at a constant rate of speed—because Morse Chains *cannot slip*. Flexible, and as positive as gears, minute Morse Chain is ideal for timing motions, for transmitting fractional HP loads.

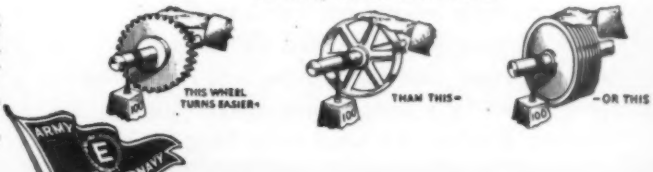
And, By Contrast . . .

Morse Chains of greater pitch are used on 30-ton Mack Trucks employed in the mining industry, in steel mills, on Diesel engine transmissions—again because they are positive in action, *cannot slip*, cannot waste power.

More efficient transmitters of power, Morse Chains are

available in sizes from 3/16" to 3" pitch—for power loads of fractional to 5,000 HP. Exceptionally long-lived, they save money as well as power, by eliminating the need for frequent adjustment and replacement, by upping machine output. Specialists, with close to half a century's experience in the field of power transmission, Morse makes better chain drives, built on the principle of . . .

TEETH, NOT TENSION



SPROCKETS CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE Roller and Silent CHAINS

MORSE CHAIN COMPANY • ITHACA, N. Y. • DETROIT, MICH. • A BORG-WARNER INDUSTRY

THE MYSTERY OF THE DAMAGED PARAPET

Production was affected . . . valuable equipment was damaged by moisture from a mysterious leak. The maintenance crew made a thorough inspection of the roof, but they found nothing. Tempers grew hot at Plant No. 3 . . . there were rumors of enemy agents . . .

"It *must* be the roof," stormed the superintendent.
"But the roof is absolutely watertight,"
protested the maintenance manager.
"We have gone over it inch by inch!"
Actually a defective parapet wall was to blame.
Storm winds forced the water through cracked
and porous masonry; and because the water
collected and dripped many feet away from
the spot where it entered, the seat of the
trouble could not be located for weeks!
This was a routine case for the Barrett Approved
Roofer—solved by a simple case of pointing up.
Barrett Roofers are used to looking for danger
points in obscure and unsuspected places.
Clogged drains, damaged flashings, broken
skylights—these may be the source of
worrisome, expensive trouble even though
the roof itself is perfectly sound.
Ask your Barrett Approved Roofer to help you
with your maintenance problems. He and his
experienced staff can give you the practical
advice and help you need—without interfering
with production schedules. Call him today,
before trouble begins—or write us direct.

THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

2800 So. Sacramento Ave.
Chicago 23, Ill.

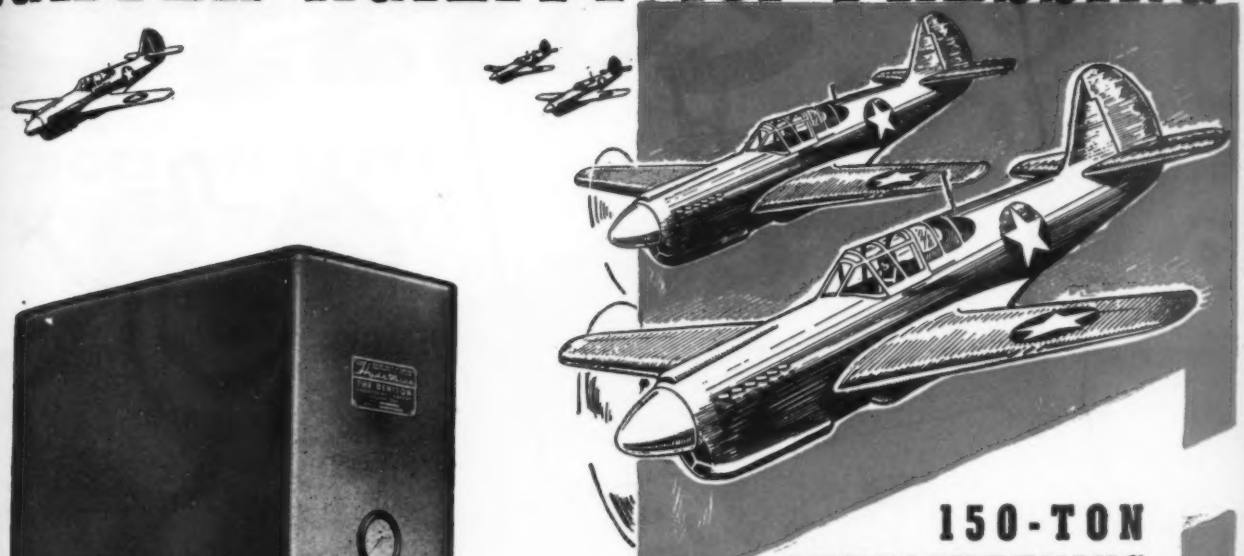
Birmingham
Alabama

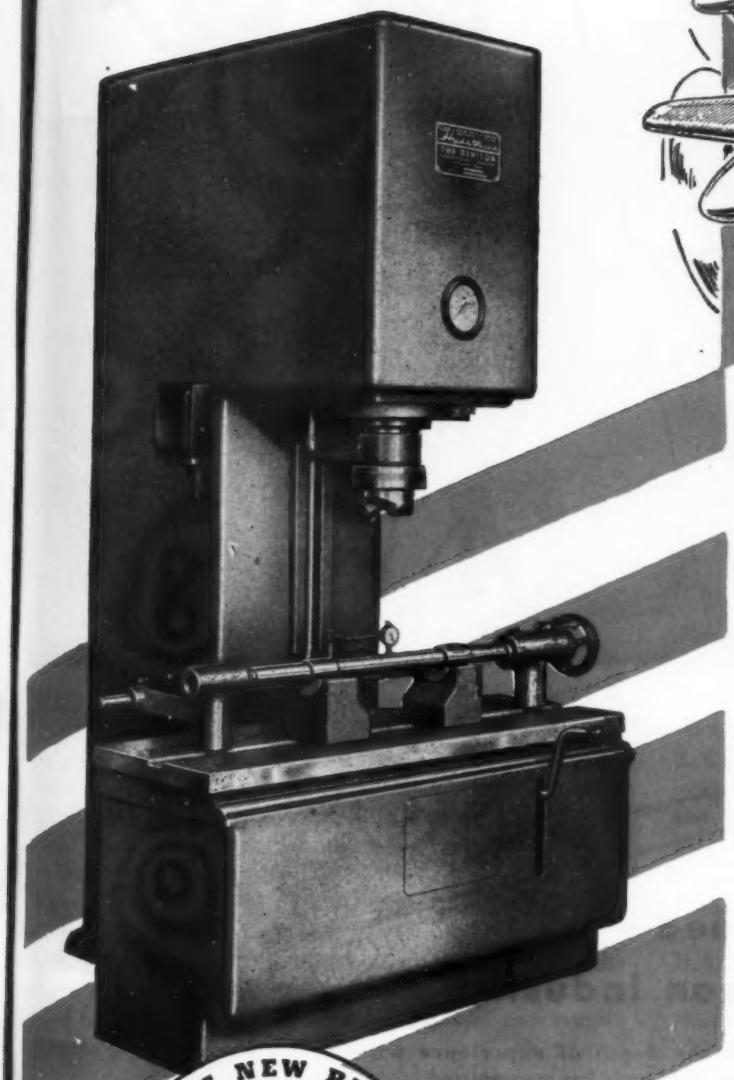
★ **BARRETT MATERIALS AVAILABLE FOR WARTIME ROOFING NEEDS. If you're building a new plant or reconditioning warehouses or other buildings, use dependable roofing materials and methods. Barrett Pitch and Felt are non-critical, and are readily available through your local Barrett Approved Roofer. Consult with him or with us on any roofing or waterproofing problems.**

Barrett Specification Roofs*

*Trade-mark Reg. U. S. Pat. Off.

FIGHTER AGILITY for PRESSING





150-TON STRAIGHTENING PRESS FEATURING QUICK ADAPTABILITY

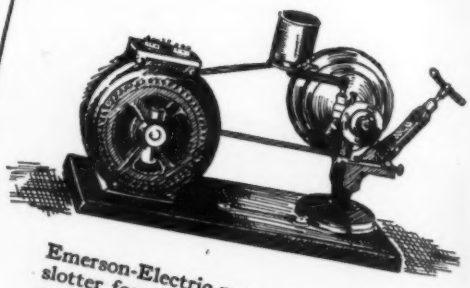
Fit as the latest fighter plane for quick action on pressing needs, this DLSC2 HydrOILic Press disposes of many straightening, assembling, bending and similar operations with oil-smooth ease and accuracy. Hydraulic operation gives it high flexibility of adjustment . . . permits the operator to regulate ram movement and pressure accurately by means of the control lever alone—while the press ram is in motion. No pre-set adjustments are necessary, yet pressure limits can be set at any point from 15 tons to full capacity, and stroke limit is fully adjustable up to 12 inches. Daylight opening is 42 inches, and the maximum throat opening is 20 inches.

Safe, easy access to the work area is assured by the DLSC2's compact, fully enclosed, round-cornered design, extra toe-space, and other safety features. Available with either foot pedal or hand-lever control. Other DLSC2 HydrOILic Presses have capacities of 25, 50 and 100 tons. For complete information, write to the Denison Engineering Company, 1154 Dublin Road, Columbus 16, Ohio.

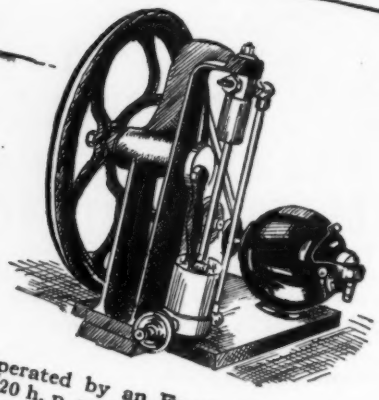
DENISON
EQUIPMENT *in* APPLIED
HydrOILics
TRADE-MARK

Pages from the
EMERSON-ELECTRIC MONTHLY
1904 and 1905

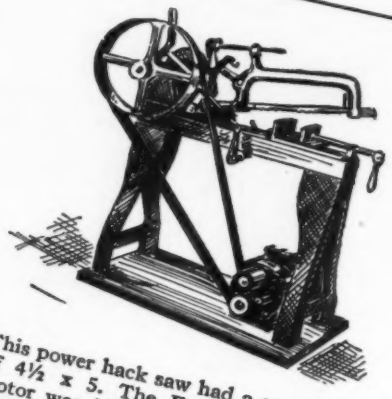
An early drill press operating at about 1800 r. p. m., equipped with ⅛ horsepower Emerson-Electric motor.



Emerson-Electric motor drives screw slotter for making "a comparatively small number of small screws." Cone pulleys provide 3 speeds.



Operated by an Emerson-Electric 1/20 h. p. motor, this air compressor was able to develop pressure of from 75 to 220 lbs.



This power hack saw had a capacity of 4½ x 5. The Emerson-Electric motor was ⅛ horsepower operating at 600 r. p. m.

How Emerson-Electric Helped to Motorize American Industry

Back in the days when the Wright Brothers were experimenting with their first flying machine, and the Panama Canal construction was just getting under way, Emerson-Electric already had a proud record of collaboration with manufacturers of motor-driven equipment.

The examples shown above serve to illustrate the depth of experience which Emerson-Electric has accumulated.

After Victory, many postwar products of American ingenuity will be powered with Emerson-Electric motors, but until then Emerson-Electric is engaged 100% in creating and producing vital weapons of war.

Electric motors and power-operated gun turrets for aircraft are being made by Emerson-Electric for service on all the battle fronts of the world.

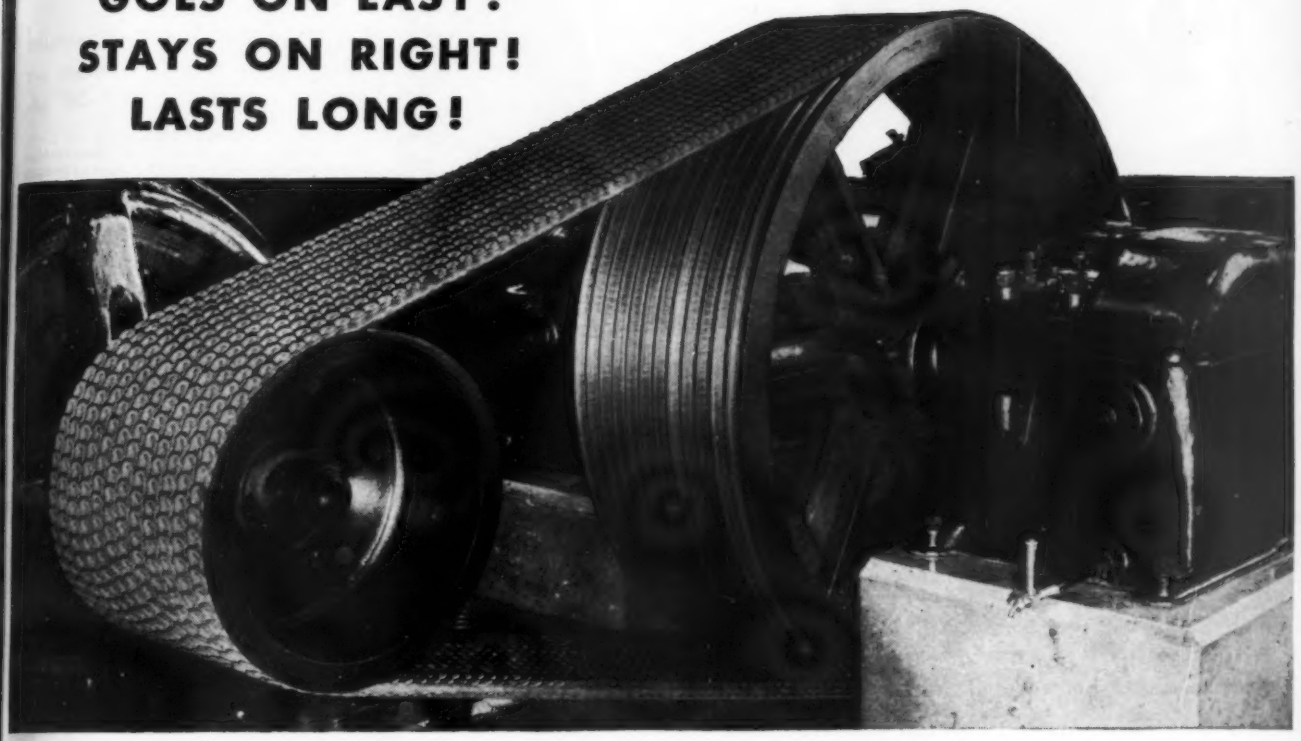
THE EMERSON ELECTRIC MANUFACTURING COMPANY, SAINT LOUIS
Branches: New York • Chicago • Detroit • Los Angeles • Davenport

EMERSON ELECTRIC

MOTORS • FANS • APPLIANCES

VEELOS...

GOES ON EASY!
STAYS ON RIGHT!
LASTS LONG!



WHAT'S the verdict on Veelos — the adjustable V-belt — by those who know from experience? Here's one! . . . after the 12-strand "E" size Veelos V-drive (shown) had given two years' service on this 250 HP compressor, a second unit was equipped with Veelos. That's just one example of how users "repeat" with this unique V-belt.

Three of the reasons Veelos buyers become Veelos enthusiasts are:

1. Ease of installation: Stock Veelos in economical rolls and, in less than 60 seconds, you can uncouple any desired length! In another 60 seconds, you can couple the belt endless and install it on the drive. Veelos "goes on easy!"

2. Controlled tension: Tension is easy to control on each individual strand of Veelos. That means controlled tension in *the entire drive!* Bearings are protected as well as belts. Veelos "stays on right!"

3. Long service: Three Veelos features combine to provide longer belt life. A. The reduction of binding stress by Veelos' extremely flexible laminated construction. B. Uniform distribution of the load on all strands through equalized tension. C. Perfect fit in the groove on all sheave diameters. Veelos "lasts long!"

Write today for *free 8-page illustrated manual* giving Veelos applications, construction detail, installation directions and engineering data.

MANHEIM MANUFACTURING & BELTING CO.
MANHEIM, PENNSYLVANIA

VEELOS
THE LINK
V-BELT
ADJUSTABLE TO ANY LENGTH
ADAPTABLE TO ANY DRIVE

"Just what I want, but...

WILL IT RUST?"

The customer is wise. He knows that the beauty of painted iron or steel may be only "skin deep," and that, unless the article is Hot Dip Galvanized, its attractive appearance and serviceability will soon be marred by the ugly stains of rust. From the viewpoint of customer, dealer, or manufacturer, it's false economy *not* to Hot Dip Galvanize iron or steel.

It's an accepted scientific fact that Hot Dip Galvanizing gives the *most* protection against rust per dollar of cost. Hot Dip Galvanizing deposits the *thickest possible coating of zinc permanently fused to the metal beneath*, thus providing a rust-free base for paint or other decorative finish.

When you *buy* articles of iron or steel, be sure to ask, "Is it *Hot Dip* Galvanized?" If you *make* articles of iron or steel, be sure of getting a genuine and expert job of *Hot Dip* Galvanizing by sending your materials to a member of this association. American Hot Dip Galvanizers Association, Inc., First National Bank Bldg., Pittsburgh, Pennsylvania.

"If it carries this seal it's a job well done."

HOT-DIP GALVANIZING

Buy from the qualified members listed below and KNOW you are getting a genuine HOT-DIP job.

CALIFORNIA
LOS ANGELES GALVANIZING CO., HUNTINGTON PARK
EMSCO DERRICK & EQUIPMENT CO., LOS ANGELES
JOSLYN CO. OF CALIFORNIA, LOS ANGELES
WESTERN GALVANIZING COMPANY, LOS ANGELES
HUBBARD & CO., OAKLAND
JOHN FINN METAL WORKS, SAN FRANCISCO
SAN FRANCISCO GALVANIZING WORKS, SAN FRANCISCO

CONNECTICUT
WILCOX, CRITTENDEN & COMPANY, INC., MIDDLETOWN

GEORGIA
ATLANTIC STEEL CO., ATLANTA

ILLINOIS
EQUIPMENT STEEL PRODUCTS DIVISION OF UNION ASBESTOS AND RUBBER CO., BLUE ISLAND
JOSLYN MFG. & SUPPLY CO., CHICAGO
STANDARD GALVANIZING CO., CHICAGO

MAINE
THE THOMAS LAUGHLIN CO., PORTLAND

MARYLAND
SOUTHERN GALVANIZING COMPANY, BALTIMORE

MICHIGAN
RIVERSIDE FOUNDRY & GALVANIZING CO., KALAMAZOO

MINNESOTA
LEWIS BOLT & NUT CO., MINNEAPOLIS

MISSOURI
COLUMBIAN STEEL TANK CO., KANSAS CITY
MISSOURI ROLLING MILL CORP., ST. LOUIS

NEW JERSEY
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INDEPENDENT GALVANIZING COMPANY, NEWARK

NEW YORK
ACME STEEL & MALLEABLE IRON WORKS, BUFFALO
BUFFALO GALVANIZING & TINNING WORKS, INC. BUFFALO
THOMAS GREGORY GALVANIZING WORKS, MASPETH, (N. Y. C.)
ATLANTIC STAMPING CO., ROCHESTER

OHIO
THE WITT CORNICE COMPANY, CINCINNATI
THE FANNER MFG. CO., CLEVELAND
THE NATIONAL TELEPHONE SUPPLY CO., CLEVELAND
THE SANITARY TINNING CO., CLEVELAND
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OREGON
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PENN GALVANIZING CO., PHILADELPHIA
HANLON-GREGORY GALVANIZING CO., PITTSBURGH
OLIVER IRON & STEEL CORPORATION, PITTSBURGH

RHODE ISLAND
JAMES HILL MFG. CO., PROVIDENCE

WASHINGTON
ISAACSON IRON WORKS, SEATTLE

WISCONSIN
ACME GALVANIZING, INC., MILWAUKEE

Not just Galvanizing but **hot-dip GALVANIZING**

Prevent Valve Failure *before it starts!*

SEDIMENT SMOTHERS WORKING PARTS...

speeds destructive wear in "Upside Down Valves"

Valves have no "upside-down stomach" to digest and dispose of destructive sediment. Because most valves are designed for upright installation, the inverted position invites a wide variety of troubles – sticking, incomplete closure, rapid wear, leakage, and eventual failure.

To make sure of efficient and trouble-free operation, plan upright installation for every service, and turn up valves in present use wherever possible. Second best to an upright position is a slightly tilted position. When it is absolutely necessary to invert a valve, be sure it is the type best suited for such conditions, and make sure it gets frequent attention. In the case of larger valves, provide a drain or suitable clean-out for blow-off purposes.

Production delays due to valve failure retard the delivery of vital supplies needed to "back the attack." Many such failures can be prevented ... by proper installation of valves, after careful selection of the proper type for the service ... by regular, systematic inspection ... by repair or replacement of worn parts ... by thorough instruction of maintenance workers.

Consult Jenkins Engineers for any assistance you need in promoting valve conservation.

Jenkins Bros., 80 White Street, New York 13, N. Y.; Bridgeport; Atlanta; Boston; Philadelphia; Chicago. Jenkins Bros., Ltd., Montreal; London.

WHY INVERTED INSTALLATION STARTS VALVE "HEADACHES"

e destructive results of upside-down installa- are illustrated in these sketches for three ferent types of valves. Similar troubles de- op in other types when inverted.

When closing valve, sediment may stick to dge faces, prevent tight closing, and cause gressive damage to seat.

Sediment accumulation prevents complete t seating necessary when repacking under ssure. Line must then be closed while re- king.

Sediment accumulates in threads on spindle d wedge, causes sticking and rapid wear of ads.

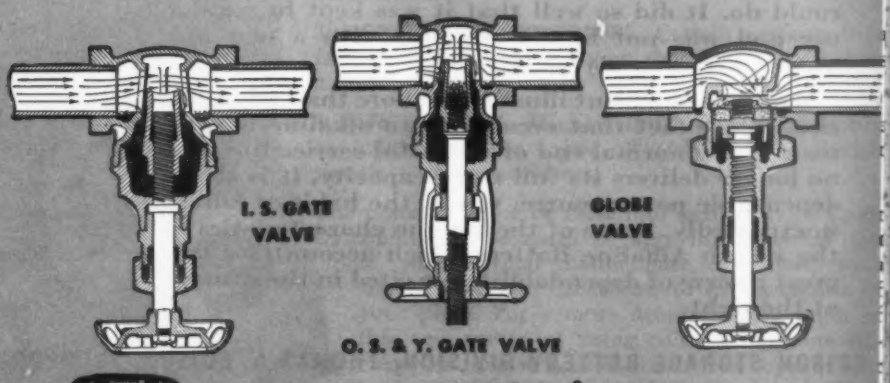
Bonnet becomes a sediment collecting mber.

Sediment and liquid, seeping down between y and spindle, causes scoring and rapid wear spindle.

Seepage through packing box of O. S. & Y. e affects operating threads on spindle, caus- izure and destructive wear.

Foreign matter lodging on disc face of a e valve prevents tight closing and accel- s disc wear.

Packing deteriorates rapidly and leakage af- spindle and handwheel.



JENKINS VALVES

For every industrial, engineering, marine and power plant service ... in Bronze, Iron, Cast Steel and Corrosion-Resisting Alloys ... 125 to 600 lbs. pressure.

HOW A SCRAP STORAGE BATTERY PINCH HIT FOR A NEW ONE

... A Salvage Story for Users of Industrial Trucks

A few years ago, an Edison Alkaline Battery, operating an industrial truck in a New England railroad terminal, was retired from service as "worn out." It had passed the usual "retirement age" and was beginning to show signs of no longer having adequate capacity for the work.

So the electrician in charge issued instructions to have it crated and shipped back to our factory for scrap credit. The battery was crated but in some unaccountable manner was not shipped. Instead, it was sidetracked into a corner of a dead storage room where it remained unnoticed for more than a year.

By lucky coincidence it was discovered again at a time when the terminal happened to be short of industrial-truck batteries. It was uncrated, charged, and put into one of the trucks just to see what it could do. It did so well that it was kept in regular use and was not finally replaced with a new one until more than a year later.

What this incident illustrates, more than anything else, is the fact that even after an alkaline battery reaches the normal end of its useful service life, and no longer delivers its full rated capacity, it is still a dependable power source, not in the habit of failing unexpectedly. Some of the unique characteristics of the Edison Alkaline Battery which account for this great reserve of dependability are cited in the column at the right.

ADVANTAGES OF THE EDISON ALKALINE BATTERY IN INDUSTRIAL TRUCKS AND TRACTORS

★ It is durable mechanically. High strength steel construction is used in the containers, grids, pole pieces, etc. The electrolyte is a preservative of steel.

★ It is foolproof electrically. It may be accidentally short-circuited, over-charged, over-discharged, or even charged in the reverse direction without injury.

★ It can be charged rapidly. It is not subject to finish-rate limitations. It requires no equalizing.

★ It withstands temperature extremes. It is not damaged by freezing. Free air spaces on all sides of all cells provide ventilation for rapid cooling under high temperature conditions.

★ It is simple to maintain. Merely charge adequately, add pure water, keep clean and dry.

★ Its tray assembly and cell connections are extremely simple.

★ Its life is so long that its annual depreciation cost is lower than that of any other type of storage battery.

EDISON STORAGE BATTERY DIVISION, THOMAS A. EDISON, INCORPORATED, WEST ORANGE, NEW JERSEY

Edison

ALKALINE BATTERIES

CAMOUFLAGE..

RIGHT..on the battlefield

WRONG.. in your plant

Color Dynamics

A new system of using color to make it easier for workers to see their work ... to build up their morale and reduce absenteeism ... to improve quantity and quality of production.

CAMOUFLAGE in a plant is never done deliberately. Without thought, colors are used which obscure and hide. As a result the workers suffer from unnecessary "eye fatigue" and nervous tension—which lead directly to absenteeism and decreased production.

In Pittsburgh's Color Dynamics, four distinct color classifications are recognized:

1. FOCAL COLORS. These are "anti-camouflage" colors—used to highlight, reveal and emphasize. They are employed to make the critical parts of a machine stand out—to give a clear contrast between the machine and the material being fabricated—to focus the worker's attention and minimize eye wandering.

2. EYE-REST COLORS. When the operator glances up from his work, he should see a color tone which rests his eyes and which does not force him to make tiring readjustments.

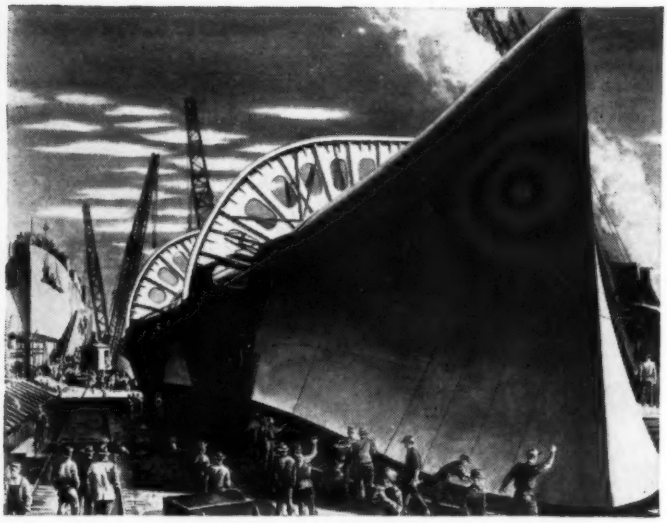
3. MORALE-BUILDING COLORS. Certain surfaces in a factory should receive colors that give the workers a "lift".

4. SAFETY COLORS. High visibility colors on mobile equipment, and to mark off aisles, act as danger signals—reduce accidents.

The practical value of these four principles of Color Dynamics may be tested by applying them (as part of your normal maintenance operation) to a limited number of machines or to one section of your plant. For a more detailed explanation of this new system of using color to promote efficiency in industry, send for a free copy of our book "COLOR DYNAMICS". Pittsburgh Plate Glass Company, Paint Division, Pittsburgh, Pa.

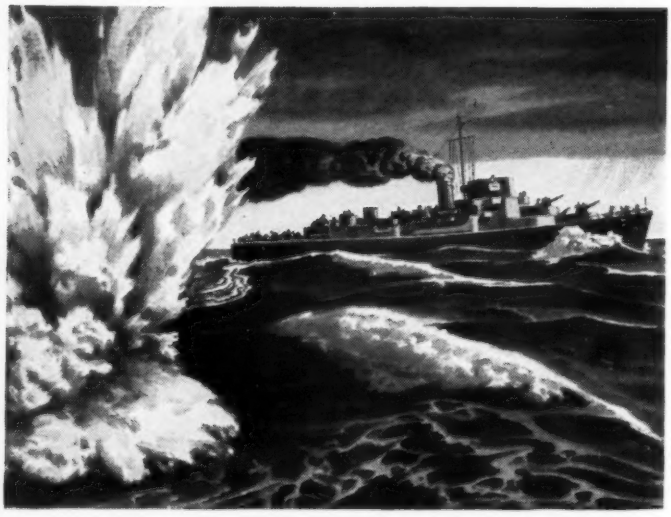
PITTSBURGH PAINTS

"PITTSBURGH" Stands for Quality Paint and Glass



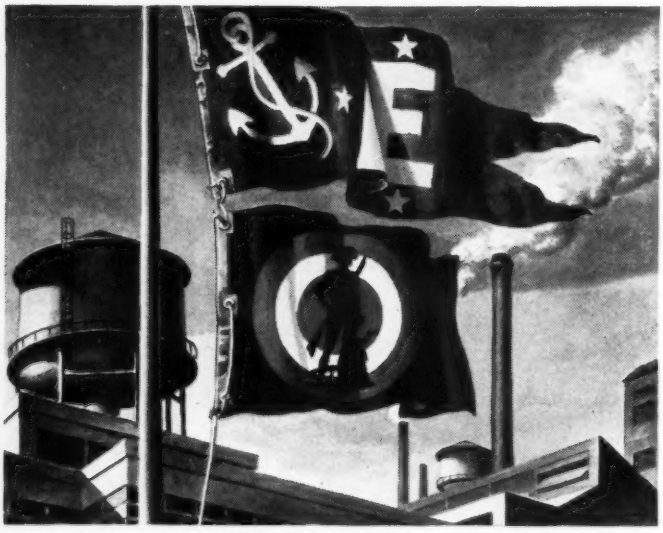
On Land!

Defoe is now building 1700-ton Navy Destroyer-Escort ships—the *largest* warships ever launched on the Great Lakes. Through its unique "roll-over" process, Defoe is able to deliver *twice the production per man hour,* resulting in double the number of ships built at *half the labor cost per vessel!* And all without a dollar of government financing.



On Sea!

With depth bombs, shell fire and ripping knife-like prows, hard-hitting DE ships, such as Defoe builds, are smashing U-boat packs and clearing the sea lanes for America's convoys. By releasing more and more destroyers for other combat duty, these battleworthy craft have added tremendously to the striking power of our Navy.



In The Air!

The Navy "E" with three White Star Renewal Citations flies from the Defoe flagstaff . . . along with the Treasury Department's special Bull's-eye flag awarded because Defoe employees regularly take more than 10% of their pay in War Bonds. And when Peace returns, the experience and ingenuity of this organization will play an important part in building new and better products for America.

DEFOE SHIPBUILDING COMPANY, BAY CITY, MICHIGAN

Three White Star Renewal Citations now decorate the Navy "E" Award won by Defoe workers.

Defoe

Ships for Victory
Servants for Peace

Is this your line of thinking?

". . . in connection with our post-war plans we are confronted with certain manufacturing operations requiring clean air, and others involving grinding dust . . . we wish information on the use of your equipment . . ."

OUR POST-PEACE PLANNING DEPENDS ON YOU!—That's an unusual statement—but it's actually a fact. For until we know what your dust problem is—we literally can't go to work—even though the equipment, around which all AAF dust control systems are engineered, is available.

Shown above is an excerpt from a letter just received by us. It is typical of so many inquiries from manufacturers now engaged in war materials production, we felt it worth while to pass their thinking on to you.

There are many advantages to starting NOW to think about your post-peace dust problems. For instance—priorities won't be automatically lifted when fighting stops—and there will develop immediately a rush for needed dust control equipment that can't be intelligently supplied without careful planning and engineering.

May we, therefore, suggest that you send for literature NOW preliminary to discussing your problems soon with one of our engineers. There is no obligation. Ask for "AAF in Industry" an illustrated booklet which describes the complete AAF line.

AMERICAN AIR FILTER CO., INC., 361 CENTRAL AVE., LOUISVILLE, KY.

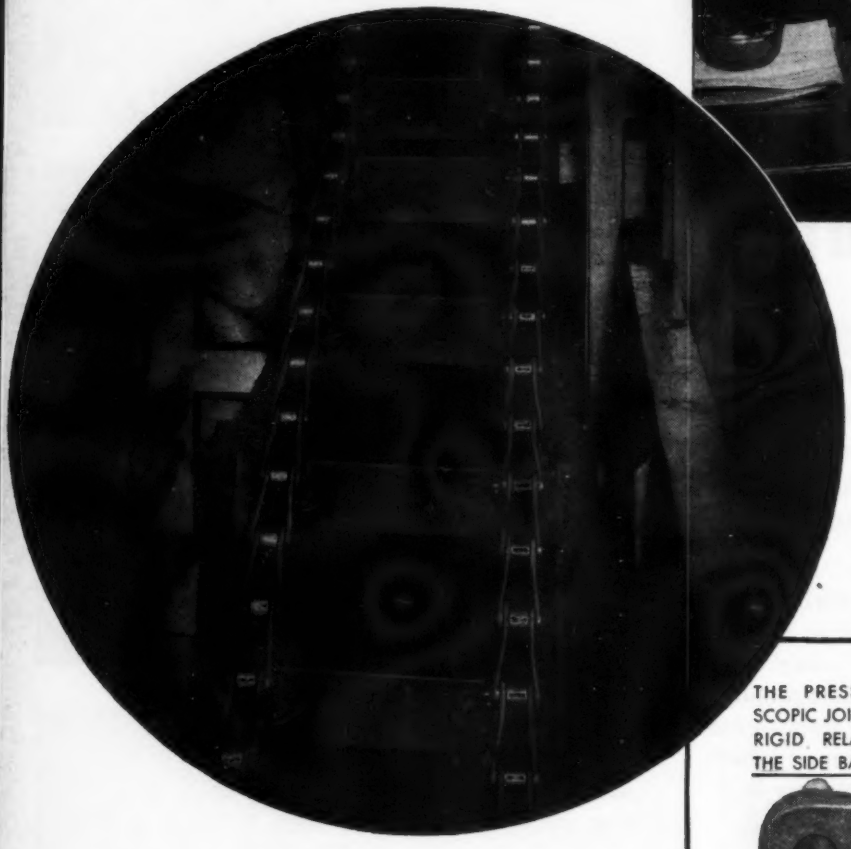
In Canada: Darling Bros., Ltd., Montreal, P. Q.

ENGINEERED AAF **DUST CONTROL**

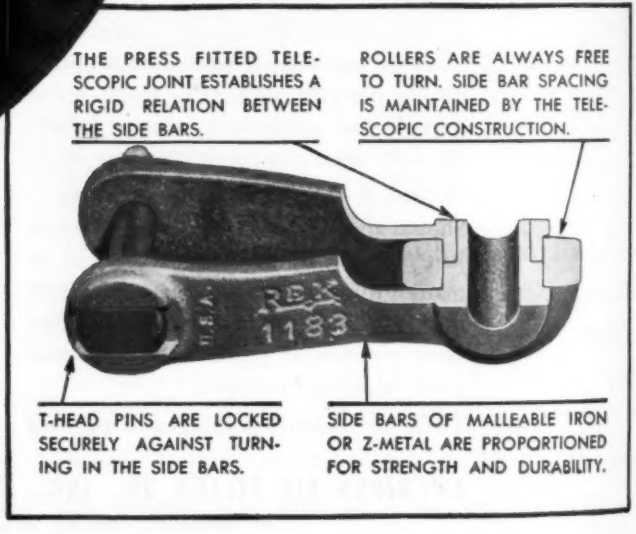
SUPPLYING CLEAN AIR FOR ALL TYPES OF INDUSTRY

THIS CONVEYOR MAKES HASTE WITH WASTE

❶ GETTING OUT THE SCRAP was a big headache in this plant. Their scrap conveyor was a jinx, if I ever saw one. No matter how much attention they gave it . . . with the best of maintenance care . . . it always managed to break down just at the wrong time and tie up the works.



❷ IT'S A DIFFERENT STORY NOW. The whole trouble centered on the chain belt. The chain they were using wasn't tough enough to stand up under the kind of service this conveyor demanded. The solution was easy. It was a made-to-order job for Rex Cast Roller chain belt. Since they made the changeover, they haven't had a bit of trouble.


THE PRESS FITTED TELESCOPIC JOINT ESTABLISHES A RIGID RELATION BETWEEN THE SIDE BARS.
ROLLERS ARE ALWAYS FREE TO TURN. SIDE BAR SPACING IS MAINTAINED BY THE TELESCOPIC CONSTRUCTION.
REX
1183
U.S.A.
T-HEAD PINS ARE LOCKED SECURELY AGAINST TURNING IN THE SIDE BARS.
SIDE BARS OF MALLEABLE IRON OR Z-METAL ARE PROPORTIONED FOR STRENGTH AND DURABILITY.

❸ HERE'S WHAT MAKES REX CAST ROLLER CHAIN TOUGH. This cutaway view shows its distinctive telescopic barrel construction. Note the way one barrel fits into the other to form a rigid link. Chain rollers roll easily and will not bind. Long life and trouble-free service are assured.

* * *

The Rex Man can help you with your chain belt and conveyor application problems; and for engineering data on Rex Cast Roller chains, ask for your copy of the 768 page Catalog No. 444. Chain Belt Company, 1667 West Bruce Street, Milwaukee 4, Wisconsin.

REX **CHAIN BELTS**

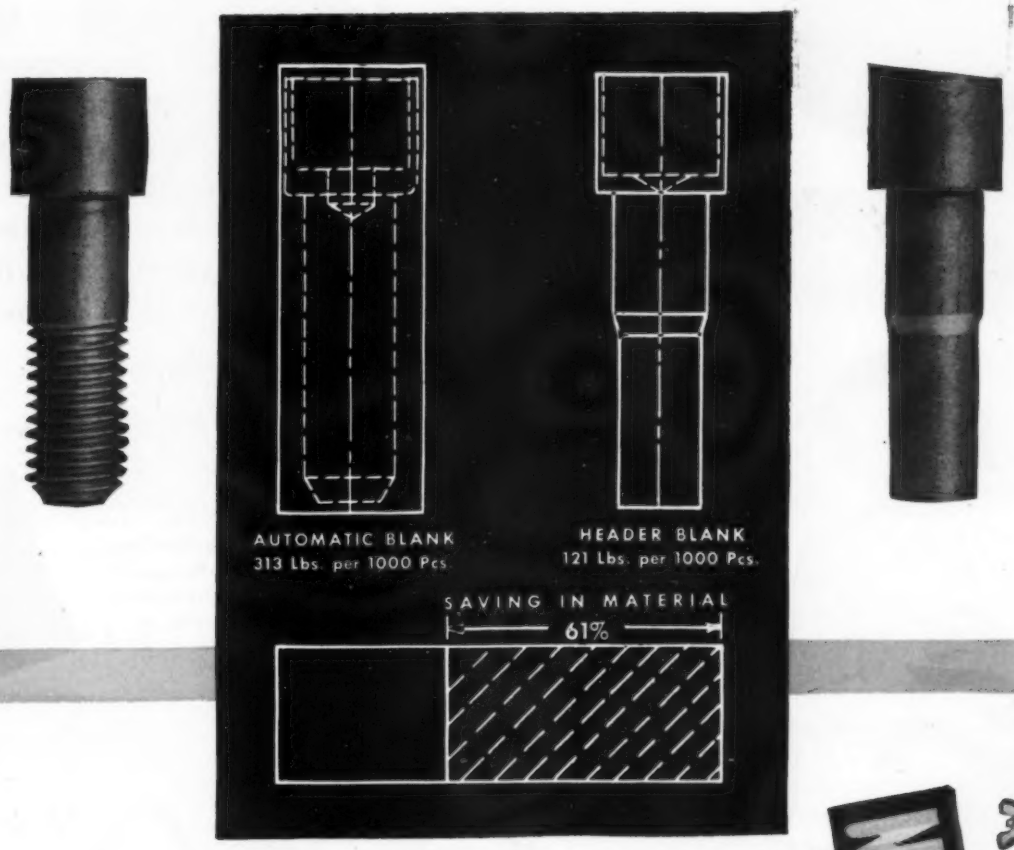
In more than 2000 sizes and types for the positive transmission of power, timing of operations and conveying of materials.

CHAIN BELT COMPANY OF MILWAUKEE

Rex Chain Belt and Transmission Division, Rex Conveying and Engineering Products Division, Milwaukee 4, Wis. • Baldwin-Duckworth Chain Belt Division, Springfield 2, Mass., Worcester 3, Mass.

Cost cut ½...

By "NATIONAL" Cold Header Method



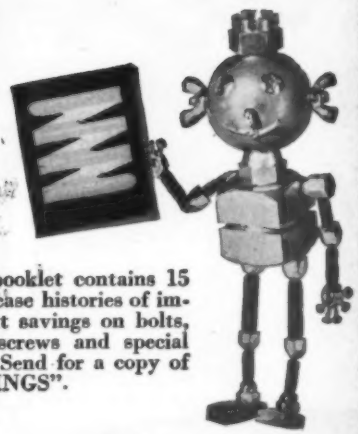
Here's a short "short story" with a profitable ending:

Chapter 1—Alert executive reads "Savings" booklet, briefly describing 15 typical jobs in which "National's" cold heading methods cut costs, saved materials.

Chapter 2—Smart as well as alert, executive sends blueprints and samples of copper part to "National".

Chapter 3—"National" engineering service and production facilities succeed in producing part at *one-half the former cost* . . . material saving, 61 per cent.

Have you seen the booklet mentioned above? It may suggest a similar saving that you can make. A request on your letterhead will bring a copy to you. Just ask for the "Savings" booklet.

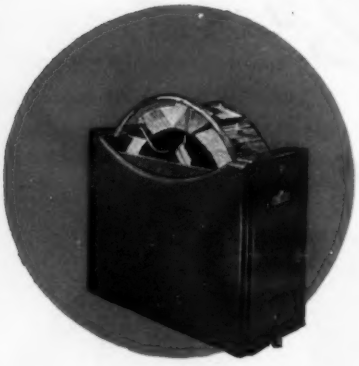


This booklet contains 15 brief, case histories of important savings on bolts, nuts, screws and special parts. Send for a copy of "SAVINGS".

National
HEADED AND THREADED PRODUCTS

THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.

—When Time, Space and Manpower are Essential Savings



Cardineer

ROTARY FILES

Hundreds of great corporations have turned to Cardineer as the most efficient means of handling records. Built on the wheel principle it houses 6000 cards within easy reach of the operator. In many concerns it has stepped up output of finding, posting and reference work as much as two and three times over old methods. Portable —compact—speedy, Cardineer aids production by releasing workers for other essential jobs. Ready now for *immediate* delivery. Comes in five models.

Write for full information.

DIEBOLD INCORPORATED

Canton 2, Ohio

ASK FOR YOURS: Booklets in time-money saving are free as follows: check and pin on your letterhead: Inventories ☐, Costs ☐, Payroll and Personnel ☐, Plant and Equipment ☐, Purchases ☐, Production ☐.

BUY WAR BONDS

DIEBOLD ARMOR
for America's Armed Forces

We are operating all our plants 24 hours a day, making armor plate for U. S. planes, scout cars and half-tracks.

DIEBOLD

"Systems to Fit the Routine"

CARDINEER	TRA-DEX	FLEX-SITE
Rotary Files	Vertical Visible Files	Visible Book

Solve the problem . . . Speed the work . . . Reduce the cost

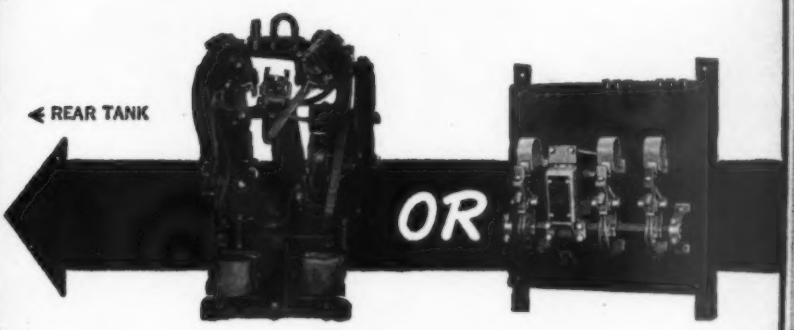
EC&M {OIL-IMMERSED / CUBICLE-TYPE} STARTERS

FOR 220-550 VOLT SYNCHRONOUS MOTORS

Companion Line to Bulletin 1076-A, Air-Break Starters

LINE AND FIELD AMMETERS
DOOR TO OVERLOAD RELAY COMPARTMENT AT RIGHT
EXCITER FIELD RHEOSTAT
FIELD-PANEL AND DISCHARGE RESISTORS MOUNTED IN THIS COMPARTMENT

STANDARD STARTER



At left above, is compensator-mechanism for reduced voltage starting and at right is contactor for full voltage starting. Depending upon the type of starter selected, one or the other of the above is mounted in oil tank at rear.

COMPLETE UNITS IN *Every* RESPECT

ELECTRONIC RELAY APPLIES D-C TO FIELD AUTOMATICALLY

View shows automatic field-panel which is mounted in lower compartment of front cubicle and is of tilting-panel type. Easily adjustable, electronic-type relay applies direct current to motor field to pull motor into synchronism automatically.

WITH all internal wiring complete and totally enclosed (NEMA Type I enclosure), these unit-type starters may be mounted out in the plant alongside the motors they control or in a separate control room.

Arranged for two or three phase service. Maximum ratings—(reduced voltage) 150 H.P., 220 volts and 300 H.P., 440 and 550 volts—(full voltage) 400 H.P., 220 volts and 800 H.P., 440 and 550 volts.

Standard features include equipment as illustrated above. Optional features include other NEMA Types of enclosures; voltmeter and other instruments; indicating light; field-removal and automatic resynchronization should motor pull out-of-step, etc.

Complete details given in Bulletin 1075-A. Ask for your copy to-day.

EC&M COMPLETELY AUTOMATIC — SYNCHRONOUS STARTERS

THE ELECTRIC CONTROLLER & MFG. CO., Cleveland 4, Ohio

Out of the Darkness!

HYDRAULICS
Rodgers
KEEP THE WORLD MOVING

Manufacturers of:

HYDRAULIC PLASTIC PRESSES
UNIVERSAL HYDRAULIC PRESSES
HYDRAULIC KEEL BENDERS
POWER TRACK WRENCHES
TRACK PRESS EQUIPMENT
HYDROSTATIC TEST UNITS
PORTABLE STRAIGHTENER
FOR PIPE AND KELLYS

BEYOND the bright searchlights of science we step into the realm of plastics chemistry — into a land of magic where anything may happen. New raw materials will produce new types of plastics as research and chemistry progresses.

Today, Rodgers engineers are developing new hydraulic presses which will be available when the world steps out of the darkness of war into the light of peace and good will. In the meantime our plant and personnel will continue working for Uncle Sam.

If it's a Rodgers, it's the best in Hydraulics. Rodgers Hydraulic, Inc., St. Louis Park, Minneapolis 16, Minnesota.

Rodgers HYDRAULIC Inc.

IS MONTH'S "BEST SELLER" ON THE PRODUCTION LI

Acme-Gridley

BULLETIN NO CM-43

MODEL RPA
4-6 AND 8 SPINDLE

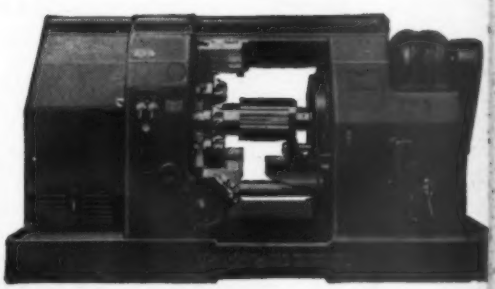
CHUCKING MACHINES

NEW BOOK
about a
ew Production Machine

duction men who have chucking work do can't afford to be without this ok—write for Bulletin CM-43, on your letterhead.

★

New Acme-Gridley Chuckers—4, 6 and 8-spindle—are engineered for new production and accuracy—to produce more at lower costs.



NATIONAL ACME CO.

170 EAST 131ST STREET • CLEVELAND, OHIO

ACME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • THE CHRONOLOG • LIMIT AND CONTROL STATION SWITCHES • SOLENOIDS • CENTRIFUGES • CONTRACT MANUFACTURING

Plan for Today and Tomorrow

INSTALL ROCKBESTOS A.V.C.

IN CIRCUITS EXPOSED TO SEVERE OPERATING CONDITIONS

ROCKBESTOS A.V.C. 600 VOLT BOILER ROOM WIRE
(Underwriters' Type AVA)

Sizes No. 18 to 4/0 AWG. This construction for sizes 18 to 8, sizes 6 to 4/0 have another wall of felted asbestos next to the conductor.

For lighting and control circuits exposed to heat and moisture, oil, grease, corrosive fumes or fire hazard, such as exist around furnaces, ovens, lehrs, soaking pits, boilers, etc., this widely used A.V.C. construction is ideal. Also for locomotive panel wiring and for switchboards requiring an asbestos braided wire.

ROCKBESTOS 600 VOLT ALL-ASBESTOS RHEOSTAT CABLE
(Underwriters' Type AI)

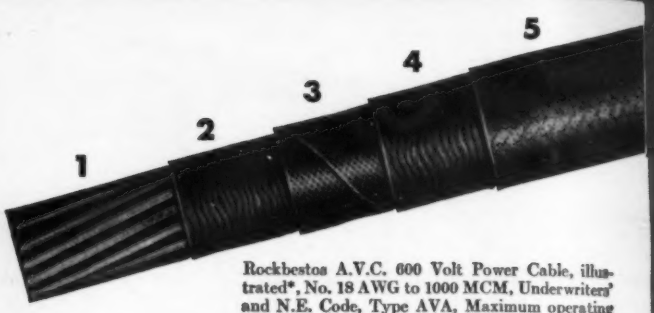
Sizes No. 18 AWG to 1,000,000 CM insulated with a heavy wall of felted asbestos, covered with a rugged asbestos braid finished in black, white or colors.

Use this power and rheostat cable for wiring rheostats, switchboards, elevator and locomotive control panels and electrical equipment exposed to heat, fumes and fire hazard. Also for general open wiring in dry, high temperature locations. For solid conductor specify Rockbestos Rheostat Wire, Table A.

ROCKBESTOS A.V.C. 600 VOLT CONTROL CABLE

In one to 19 conductors. Standard stranding AWG No. 12—19/No. 25 and No. 9—19/No. 22. Other strandings furnished.

Designed for use under conditions too severe for control cables with other types of insulation which deteriorate rapidly when exposed to high temperatures. Operates without failure under the attack of heat, oil, grease or corrosive fumes and may be installed in conduit as it has ample moisture resistance.



Rockbestos A.V.C. 600 Volt Power Cable, illustrated*, No. 18 AWG to 1000 MCM, Underwriters' and N.E. Code, Type AVA, Maximum operating temperature 110°C., has this permanently insulated construction. (Also, with lead sheath and in voltage ratings up to 5000.)

WHY PERMANENTLY INSULATED ROCKBESTOS A.V.C. WILL GIVE YOU DURATION-PLUS SERVICE*

1. The conductor is perfectly and permanently centered in helically applied insulation.
2. Impregnated asbestos insulation withstands the heat of overloads up to the melting point of copper and won't ignite or burn.
3. Lubricated varnished cambric for high dielectric strength and added moisture resistance, protected from heat and flame by two impregnated asbestos walls.
4. Outer impregnated asbestos wall which serves as a heat-barrier against high ambient temperatures.
5. A tough, rugged, impregnated asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.

**One of 122 different wires and cables developed for severe operating conditions by Rockbestos.*

Won't bake brittle, burn, flow or rot.
Resists moisture, oil, grease and fumes

In wartime, you want wires and cables in circuits that run around furnaces, lehrs, boilers, steam tunnels, etc. that give trouble-free service no matter how severe the operating conditions. And not only do you want them to give duration service but also freedom from wire-failures for years to come.

Rockbestos A.V.C. *permanently insulated* wires will give you just that kind of performance. Because the *permanent* impregnated asbestos insulation is highly resistant to heat, flame, moisture, oil, grease and alkalies, it won't bake brittle, crack, bloom, rot, flow or swell under the severest conditions. When installing new circuits, or rewiring old, plan for both today and tomorrow—install Rockbestos A.V.C. in all circuits exposed to wire-destroying conditions.

When inquiring or ordering, please furnish CMP allotment number or symbol with proper certification. For samples and literature write nearest branch office or:

Rockbestos Products Corp., 932 Nicoll Street, New Haven 4, Conn.

For Victory
Invest in U. S. War Bonds

ROCKBESTOS A.V.C.
The Wire with Permanent Insulation

NEW YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.

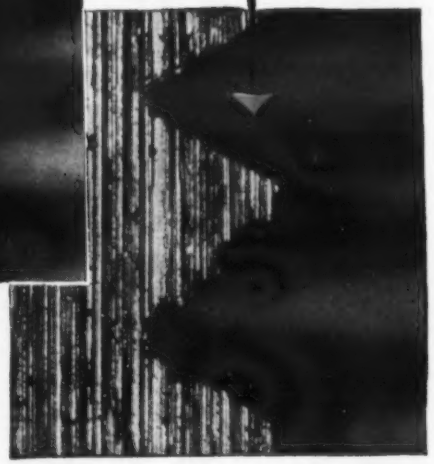
Shakeproof Lock Washers
In a variety of types and sizes.
Shakeproof Cowl Fasteners
"The Quick-opening Lock"
Sems Fastener Units
Pre-assembled Shakeproof Lock Washer and Screw.
Distributor of Shakeproof Products Manufactured by ILLINOIS TOOL WORKS
2501 North Keeler Avenue, Chicago 39, Illinois
Plants at Chicago and Elgin, Illinois
In Canada: Canada Illinois Tools, Ltd., Toronto, Ontario

Omaha Public Library
Reference Dept.

Stronger.. BECAUSE IT FITS Tighter!

Photomicrographs showing:

- Typical snug-tight fit of Type 1 Shakeproof Thread-Cutting Screw.
- Typical loose fit of ordinary machine screw in pre-tapped hole.



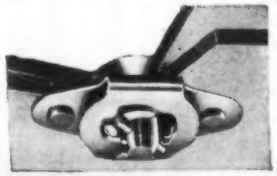
THE SCREW WITH THE "BUILT-IN" TAP!

SHAKEPROOF
THREAD-CUTTING SCREWS

Exclusive thread-cutting slot provides sharp serrated cutting edge. Each screw taps and fastens in one operation... reduces costs and improves product performance.

GOOD DESIGN DEMANDS MODERN FASTENINGS!

Shakeproof Lock Washers
In a variety of types and sizes.



Shakeproof Cowl Fasteners
"The Quick-opening Lock!"

Sems Fastener Units
Pre-assembled Shakeproof Lock Washer and Screw.

WRITE FOR FREE TEST KIT!

ARMY NAVY

SHAKEPROOF inc.
"Fastening Headquarters"

Distributor of Shakeproof Products Manufactured by ILLINOIS TOOL WORKS
2501 North Keeler Avenue, Chicago 39, Illinois
Plants at Chicago and Elgin, Illinois In Canada: Canada Illinois Tools, Ltd., Toronto, Ontario

VOLUME 102, NUMBER 3 · MARCH, 1944

How to Put Your Grinders "in the Pink"

Here's what the new *blue flash* trademark on Bay State grinding wheels means—

Fast. Only Bay State offers fractional grades—three degrees of hardness in a single grade. No more trouble due to a wheel being *a trifle* too hard or *a trifle* too soft. You can match the job requirements *exactly* — to get FASTER production.

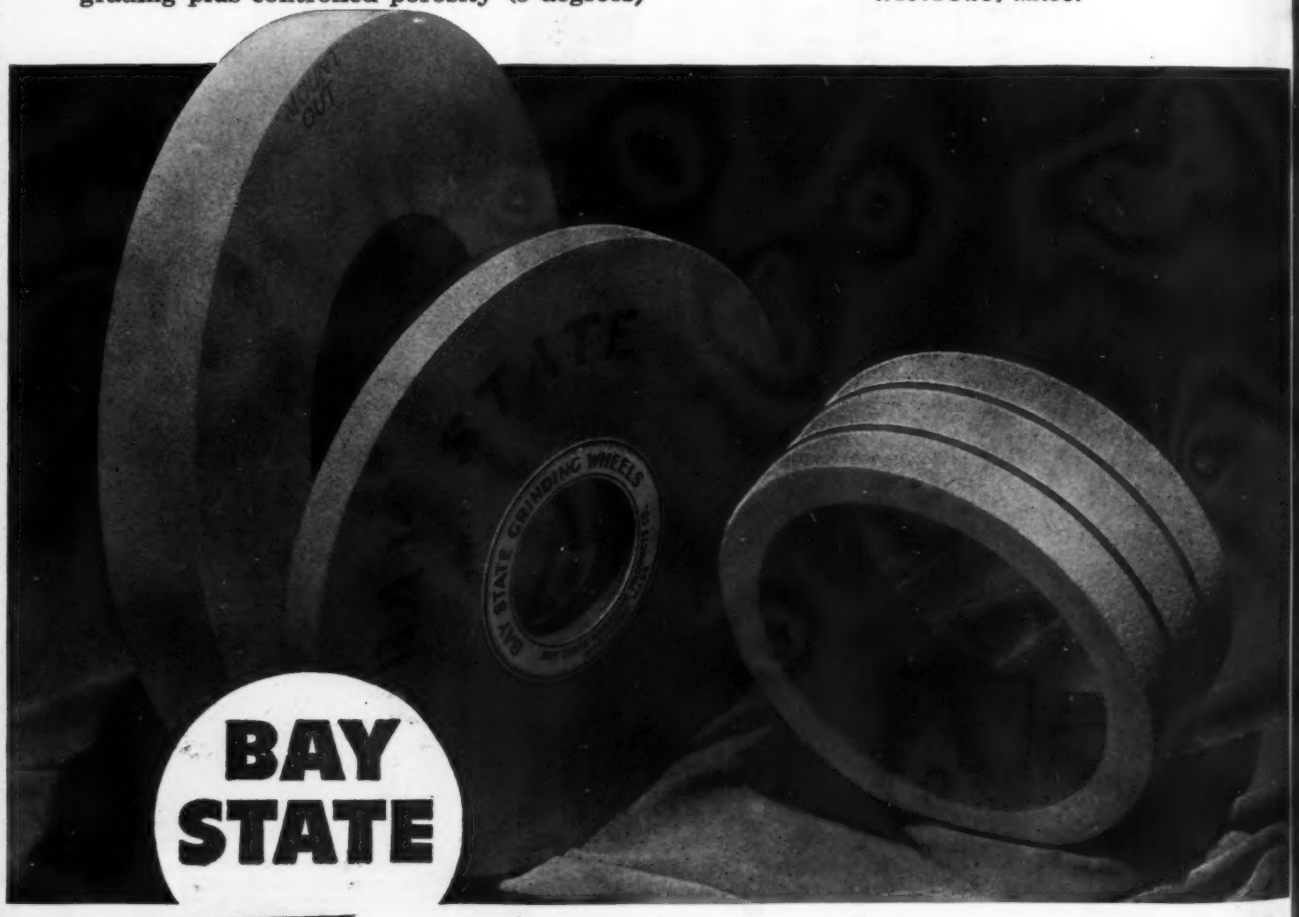
Cool. Bay State's own development in bonding — H9 vitrified (recommended for most surface and centerless grinding) — has *extra* strength, so less is needed to hold the abrasive grains. Wheels can be more porous, COOLER-cutting.

Bay State also offers a stronger guarantee of the same *results every time.* Fractional grading plus controlled porosity (8 degrees) permit very close duplication once a satisfactory wheel has been selected.

Bay State leadership in quality has been mounting during the war. Its acknowledged reputation for the finest honing and superfinishing stones, has extended rapidly into all the lines represented in the drawings below. And Bay State engineering offers specialized services to help you determine the exact wheel for your needs.

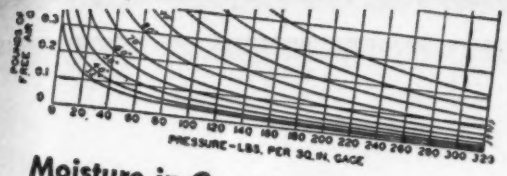
Make a test to determine if fractional grading plus other Bay State advantages won't give you better results. The first step is writing us for Bulletin A.

BAY STATE ABRASIVE PRODUCTS CO.
WESTBORO, MASS.



BAY STATE BLUE FLASH GRINDING WHEELS *FAST and COOL*

HONING AND SUPERFINISHING STONES · CUT-OFF WHEELS · INSERTED NUT DISCS · AND CYLINDERS
PORTABLE SNAGGING WHEELS · MOUNTED WHEELS · AND POINTS · GRINDING WHEELS



Moisture in Compressed Air . . .

There is no such thing as *dry* Atmospheric Air. According to records of the U. S. Weather Bureau — collected from widely separated points in the United States — the yearly average humidity shows a high of 86.5% and a low of 40.5%.

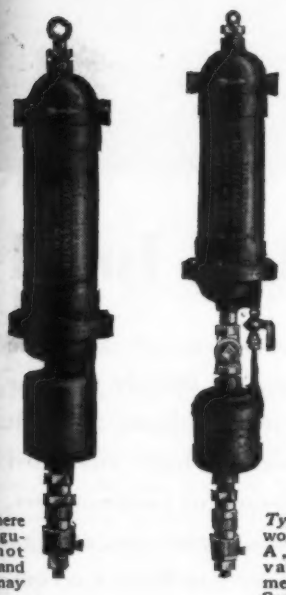
Assuming that free air with an average humidity of 60% is compressed to 90 lbs. gauge in a single stage compressor, its temperature at delivery will usually be well above 300° F. Relative humidity at this high temperature will be quite low, *although the air still carries all the moisture with which it started.* If it could be used "hot," some of the troubles due to precipitation of moisture would disappear. But usually the air must be carried by pipe line or hose to work located at some distance from the compressor, and during this transportation the temperature of the air falls, and condensation forms.

Moisture condenses into actual water, forming a mist until the saturation or *dew point* is reached, when the water is freed and settles in the pipe line, to be carried along by the air stream. In this way the moisture gets into the mechanisms of pneumatic machines, and appears as "rain" in the air streams at the nozzles.

Condensed moisture will not precipitate into a trap or any airbound receptacle while the air is in motion. It will collect in such trap while the air is quiet, but will again be picked up and carried along when the air reaches sufficient velocity. Thus the hand-operated or automatic intermittent trap does not succeed in freeing the air of all of its entrained moisture.

Swendeman Separators

free air of entrained moisture, oil and dirt.



Type A – where pressure regulation is not necessary, and moist air may be shut off.

Type C – same work as Type A, but has valve equipment between Separator body and Eliminator.

The Swendeman Separator is not a trap: it is never closed, and retains no oil or water. Air, laden with moisture, oil, dust particles and scale, is caused to pass successively through two vertical expansion chambers within which the heavier globules of oil and water — and other foreign matter — separate from the air and fall to the bottom, passing through a Separator Drain into a Pressure Equalizer chamber, from which they are discharged to atmosphere. This separation and discharge are continuous, and result in delivery of clean dry air at the point of work.

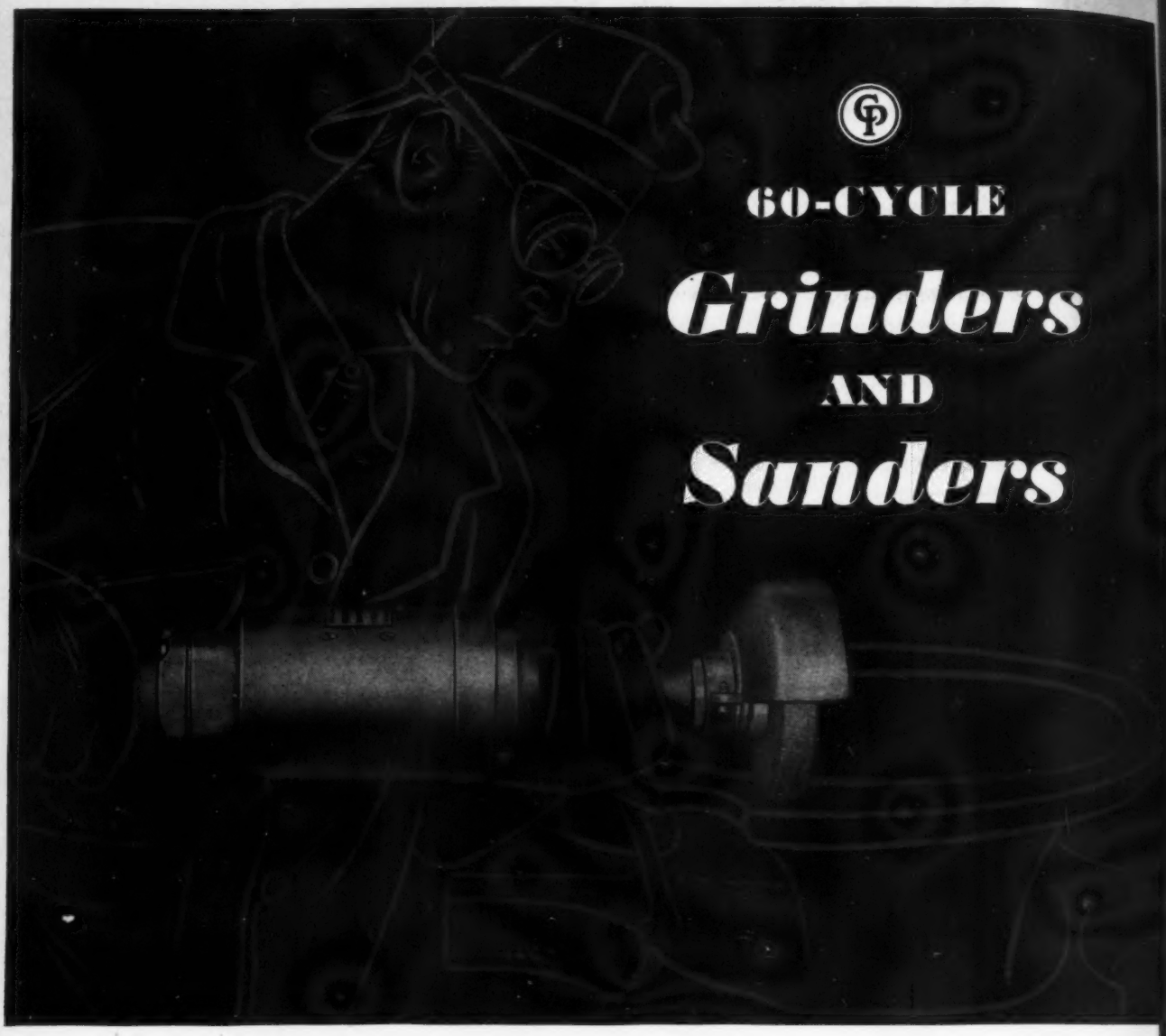
The number of separators required, their sizes, types and locations, depend upon the size of the system, the work performed, type of compressors used, and whether after-cooling or re-heating apparatus is employed in the lines.

The savings that result from removal of entrained oil, water, dirt and scale, justify full and proper use of Swendeman Separators. Air tools and machines operate better and last longer with less maintenance: spray painting, drying, cleaning and other operations call for the use of clean dry air, if the work is to be performed satisfactorily. Power is often saved, and compressors work at higher efficiency when the air stream is relieved of the dead weight of water. Air lines are less liable to costly breakdown due to rusting, clogging and freezing.

So . . . it should pay you to have a Swendeman Engineer go over your air system and make recommendations. The cost of the apparatus is moderate, and actual installation is not at all complicated. Why not look into it now — *and be ready when the great Day comes!*

SWENDEMAN
Automatic Separator
A DEXTER PRODUCT

The LEAVITT MACHINE COMPANY
ORANGE, MASSACHUSETTS



. . . maintain speed under load

IDEAL for plants whose operations do not warrant the installation of high frequency tools — or plants that have such tools but lack high frequency power lines at points where additional tools could be advantageously used, CP-460 Grinders and Sanders afford fast, uniform grinding and sanding. They have a powerful, efficient, lightweight induction motor of the same type as the well-known CP Hicycle Grinder but operate on 60-cycle, 3-phase, 220-volt A.C. This motor insures high sustained speed under load. Absence of commutators, brushes, brush holders, armatures, etc., assure lower maintenance costs. Write for complete details on CP-460 Grinders, Sanders.

★★★★★★★★★
PNEUMATIC TOOLS
ELECTRIC TOOLS
(Hicycle...Universal)
ROCK DRILLS

CHICAGO PNEUMATIC
TOOL COMPANY
General Offices: 8 East 44th Street, New York 17, N. Y.

★★★★★★★★★
AIR COMPRESSORS
VACUUM PUMPS
DIESEL ENGINES
AVIATION ACCESSORIES

Available IN COMBINATION UNITS, TOO...

The Monitor THERMALOAD V

SOLENOID STARTER

WITH *Compensated* OVERLOAD RELAY

Get all the facts about the Monitor Thermaload V Solenoid Starter. Learn how the unique Monitor COMPENSATED overload relay prevents unjustified shutdowns under high temperature conditions and assures maximum overload protection under low temperature conditions. Learn about the Monitor tamper-proof reset button . . . why Monitor contacts are of pure fine silver . . . why the Thermaload V reduces motor maintenance costs, adds life to motors. These and many other important details and facts are discussed thoroughly in Bulletin 6300.

Ask the Monitor field engineer in your territory for a copy or write direct.

Ask Yourself these Questions

ARE MY MOTORS
up to 3 H.P., 110 Volts, A.C.?
up to 7.5 H.P., 550 Volts, A.C.?

ARE THEY
single-phase? two-phase? three-phase?

DO I REQUIRE
general purpose enclosure (N.E.M.A. Type I)?
dust-tight enclosure (N.E.M.A. Type V)?
water-tight enclosure (N.E.M.A. Type IV)?

IS WIRING TO BE
front-of-board? back-of-board?

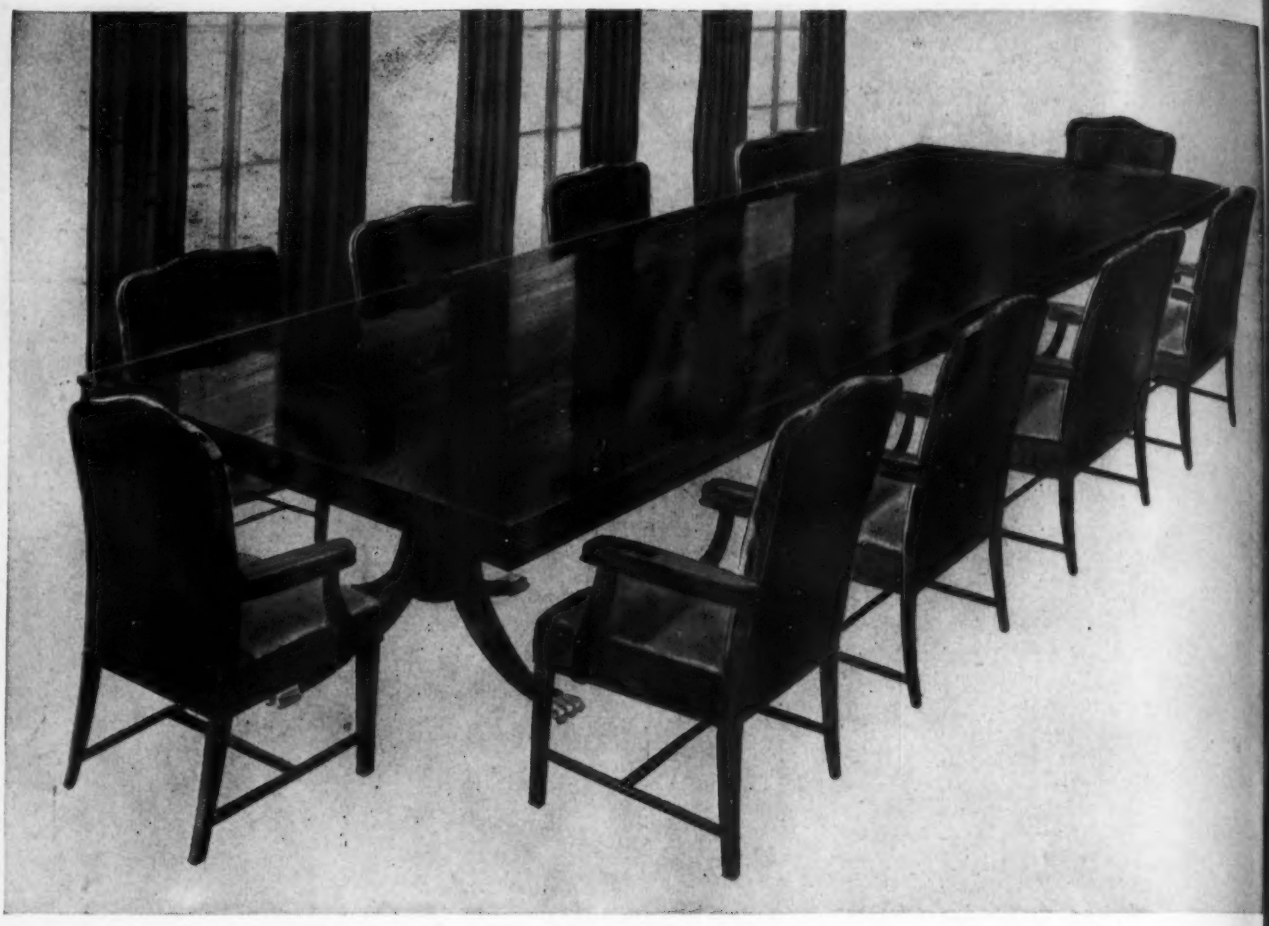
AM I INTERESTED IN MAXIMUM OVERLOAD PROTECTION FOR MY MOTORS?

If the answers are **YES** . . . then you can take advantage of the many benefits that Monitor Thermaload V Starters offer.

The Monitor Controller Company

GAY, LOMBARD & FREDERICK STS. BALTIMORE-2, MARYLAND

Monitor — The Original — BALTIMORE, MD.



LET'S HOLD A PEACE CONFERENCE—NOW

The public, during war times, may be content to go without your products. But it is quite possible that consumers may not want to wait too long for them after peace comes. Quick production of your products at that time may require "outside" manufacture of machine tooled parts or even of complete mechanisms.

So why not hold a "peace conference," in advance of peace, where, if you please, we can be invited in to discuss your future plans to produce civilian goods? It might be of great importance to you in speeding production later when delivery to market is urgent.

It's true we can not take contracts now for immediate delivery, because of our serving the Army and the Navy, as we have been for over twenty years. The Army-Navy "E" and four stars have been awarded to Pollak for continued high achievements in the production of bomb racks, bomb shackles, fuzes and other war equipment.

We will not deny that this recognition of merit for our performance for our armed services is highly gratifying to us. But unless it also indicates to our future peacetime customers that we can develop an build good products for them well, its significance will have bee lessened.

Pollak has the ability, equipme and plant to develop and produc not only fine precision products b also the capacity to produce the in required quantity—and on tim

That is why we believe our exec tives and engineers have much t offer in the way of valuable know edge, techniques and experience. your suggestion they will be glad t gather around your planning-fo peacetime-products conference ta —without obligation.

POLLAK PRECISION PRODUCTS

Five Army-Navy "E" awar — the Flag and Four Star each of which symbolizes months of Exacting Service our Armed Forces, have b awarded to Pollak.

POLLAK MANUFACTURING COMPANY • ARLINGTON, NEW JERSEY

DEVELOPING • DESIGNING • FABRICATING • STAMPING • SPINNING • WELDING • FINISHING • MACHINE WO

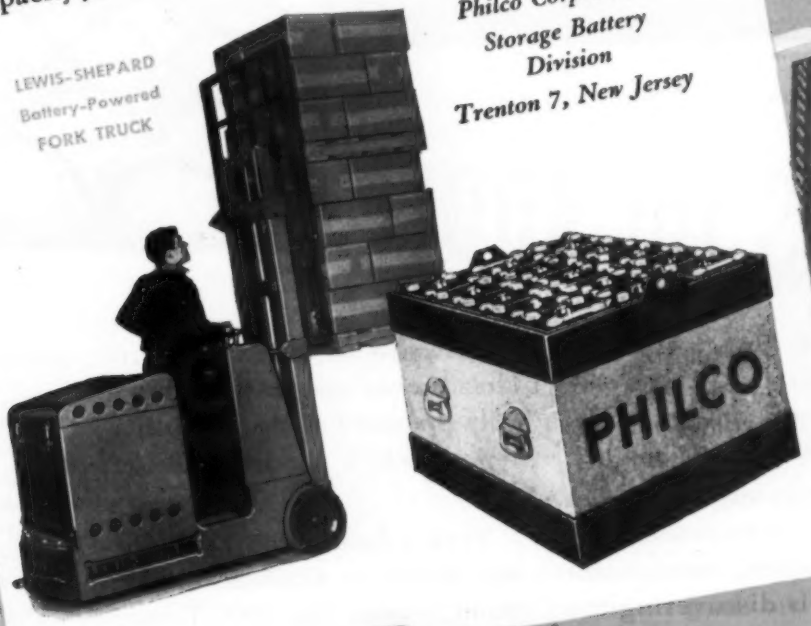
PHILCO "XL" BATTERIES

put 10% more power capacity in your present Electric Industrial Trucks!

YES, with Philco "XL" Batteries, your present electric industrial trucks will haul 10% more material! You'll get this extra work out of your materials handling equipment because Philco "XL" Batteries provide 10% extra capacity at no increase in overall battery size! Now, when you need maximum service from your trucks, find out about Philco Batteries. Drop us a note stating truck make and model. We'll tell you exactly how much more ampere-hour capacity you can get with a rugged, dependable Philco!

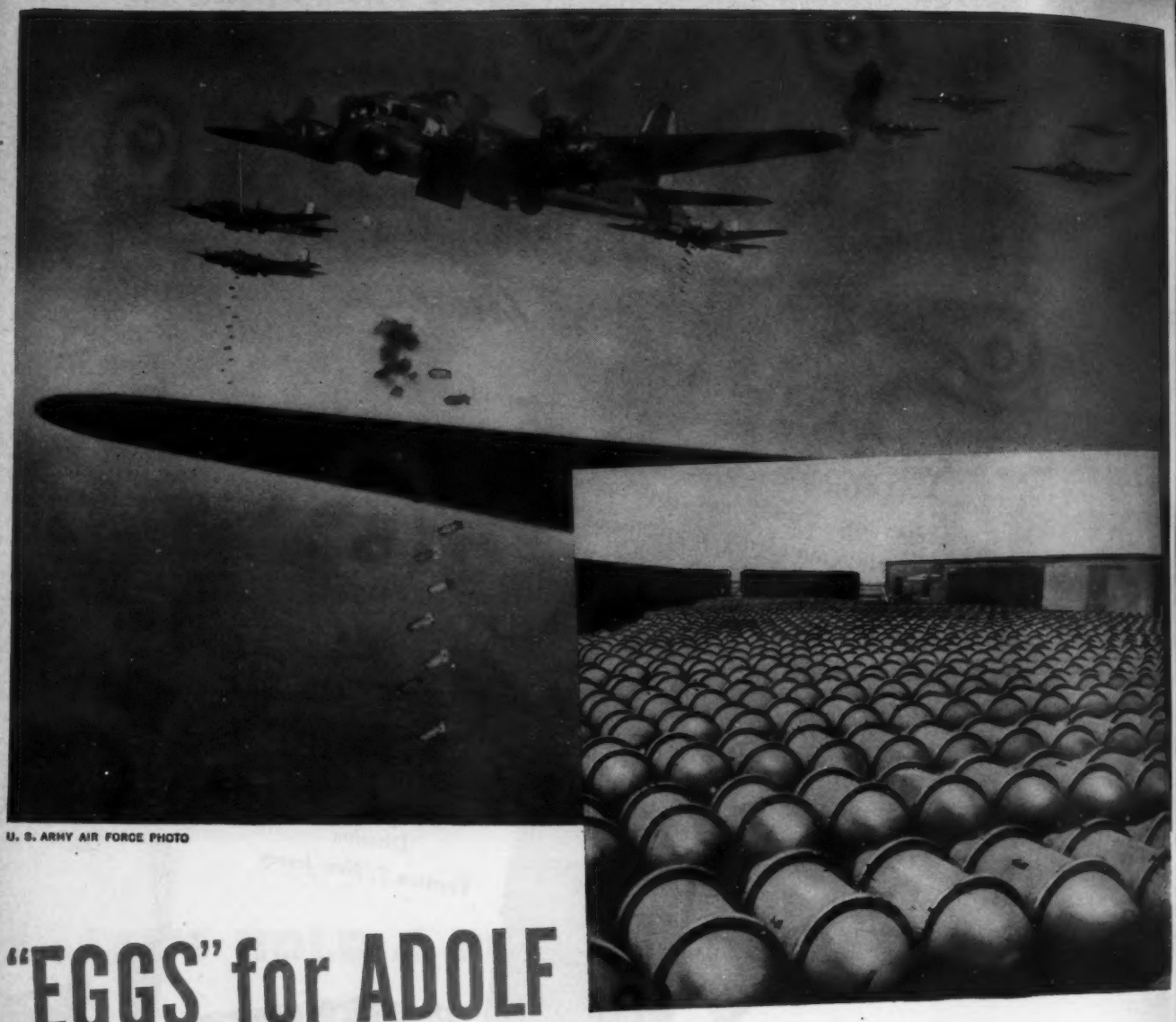
Philco Corporation
Storage Battery
Division
Trenton 7, New Jersey

LEWIS-SHEPARD
Battery-Powered
FORK TRUCK



Specify

PHILCO
INDUSTRIAL TRUCK BATTERIES



U. S. ARMY AIR FORCE PHOTO

"EGGS" for ADOLF

REMEMBER this—every bomb dropped on an enemy target, every bullet, projectile or torpedo fired must be replaced by another.

In meeting the added problems incident to the mass manufacturing of munitions, management everywhere is discovering the practical help available through Texaco Engineering Service and Texaco Products.

So effective have Texaco lubricants proved that they are definitely preferred in many fields, a few of which are listed at the right.

Texaco Lubrication Engineering Service is available to you through more than 2300 Texaco distributing points in the 48 States. The Texas Company, 135 E. 42nd St., New York 17, N. Y.

THEY PREFER TEXACO

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

TEXACO

TEXACO Lubricants, Fuels and Engineering Service

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

Disposal of Government Inventories

How to dispose of government surpluses when the war ends need not be an insuperable problem – if we face it promptly and intelligently. But if we do not, peacetime markets may be disrupted, government funds wasted, production discouraged, and reconversion of the whole economy to peace seriously hampered.

What we need most in order to attack the problem is estimates of how much surplus there will be, in what types of goods, and where.

At the war's end, government inventory of war goods is likely to total around 60 billion dollars. Most of this will consist of aircraft, ships, and other ordnance. Only some 15 billion dollars or less will be in food, clothing, trucks, tools, chemicals, medical supplies, transportation, engineering and communication equipment, and other goods for which there is a civilian market.

In addition, war contractors will have about 10 billion dollars of inventories, the bulk in specialized raw materials, goods in process, and finished products. Only about one-fifth of the total, or some 2 billion dollars, will be marketable or usable for civilian purposes. While the government takes over the usable inventory, the ex-war-contractors will have to build up their stocks for peacetime production, so that on balance, they will not be disposing of usable inventories in large volume.

Not even all of the usable war-end inventory will be "surplus" for sale to civilians in competition with new production. Some of it will be needed by the sizable peacetime Army and Navy we are likely to maintain, and such additional items as can be stored without serious deterioration or obsolescence will be held against possible future war emergencies. Some of it will be disposed of abroad. And up to half of it will be abroad and may be sold there or used for relief.

After allowing for these factors, the war supplies to be disposed of in our own markets probably will be less than 10 billion dollars (cost basis). While the total is not overwhelming – the equivalent of two months' retail sales – in certain lines the surplus will be several years', instead of a few months', normal supply. In particular, the volume of scrap metals available from otherwise unusable munitions will present a problem.

A great deal can be done now to reduce the size of the postwar surpluses by achieving a better balance between military needs and supplies and avoiding excessive inventories of particular raw materials or finished goods. This work needs to be pressed, not only to simplify our transition to peace but also to prevent wasting productive energies during the war. Furthermore, when the war ends on one front, inventories of war materiel should be worked down to the reduced scale of remaining military activity.

We cannot develop programs of action until we know approximately how much of each type of item is to be sold, and where and when it will be available. Wide margins of error are inevitable as long as large-scale procurement and large-scale consumption are still taking place; yet such information is essential and must be developed. Indeed, improved inventory records and estimates are badly needed for the conduct of the war as well as for managing the surpluses after hostilities cease.

In decisions on the disposal of war-goods inventories, the public interest must be the prime consideration. Proposals that none of these goods should be sold domestically because of competition with new production obviously are untenable. Everything that is not needed by the Armed Services or for other special purposes should be disposed of ultimately. The real problem is not whether surpluses should be sold, but rather to whom, at what price, and at what time the sale should be effected.

In the distribution of such large quantities of goods, we believe that established trade channels should be used wherever possible. Otherwise, we shall witness widespread speculation in war goods and the mushroom growth of inefficient and disruptive fly-by-night distributors. This will benefit only a few speculators and will discourage legitimate producers and distributors from making their normal commitments.

All war contractors should have the privilege of retaining those inventories for which they are willing to pay actual cost or a fair price negotiated with the gov-

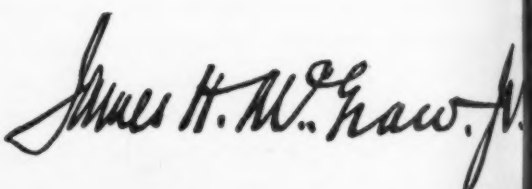
ernment procurement agency. The balance of the inventories in the hands of war producers should be assembled by the government and sold in an organized manner. It is of great importance that the plants be cleared of these inventories at once so that the process of conversion to peacetime operation can proceed without further delay. To accomplish this, preparations must be made before the end of the war for speedy determination of the inventories to be moved and for a huge volume of storage space to accommodate them.

The price which can be realized and the timing of sale are closely related. Certainly the best prices will not be secured if the government attempts to dispose of large supplies of material and products suddenly without regard to market conditions. Most businessmen rightly favor an early transfer of surplus inventories from government to private ownership. But, they also realize that if all the surpluses are dumped indiscriminately as they become available, many markets will be badly depressed, and the resulting low prices will bring lower production. If this depression effect becomes general, as it easily can, it will be costly to the nation in terms of jobs, income, and goods.

In industries in which production is inadequate to meet postwar demands, an immediate sale of government inventories can prevent inflated prices and preserve balanced market conditions. In cases in which the surpluses are large in relation to annual production, the disposition can be scheduled over a period of years. Generally, however, it will be best to clear the surpluses as quickly as orderly sale can be accomplished rather than to leave them as a continuing threat overhanging the market. Most industries can, and should, take the disposal process in their stride without special dispensations from the government. In this connection, it should be noted that the tax provisions for carry-back of losses and excess profit credits after the war greatly increase the possibilities for speedy disposal of surpluses without serious injury to producers.

There will be some industries, however, in which the postwar surplus is so large that it would practically saturate the market for years to come. The problem of these industries is further complicated by their wartime expansion of capacity many fold in excess of peacetime requirements. These lines of production are, moreover, crucial for our national defense. Aircraft and shipbuilding are cases in point. Each of these situations calls for careful study and discussion by all concerned to devise means to keep alive the necessary production organizations, the research effort, and the spirit of enterprise. Insofar as possible, the individual manufacturers should work out their own salvation in the conversion to peacetime markets. They can do this by taking on new lines, by increasing their production efficiency, and by developing technical improvements which make the existing inventories obsolete. But they still will need some kind of government protection or assistance while the huge surpluses are being worked off. It is most important, however, that such protection or subsidy be limited to a period of three to five years. It must not become permanent unless it is really essential for our national security.

The disposal of surplus inventories is part of the whole process of demobilization of the war effort and conversion to peace. If this process is to be accomplished with minimum dislocation and injury to our economy it will have to be directed by a central agency which has developed adequate information service and is in position to coordinate the policies of the Armed Services and the other interested executive branches of the government. This agency should draw freely on the knowledge of businessmen in the specialized problems of marketing surpluses in each industry. It should formulate definite programs of inventory disposal for all industries in which the problem is acute; and it should make these programs public as soon as possible, so that business can plan for the future with confidence. In large measure, the success with which we make the economic transition to peace will depend on the quality of government administration in the process of industrial demobilization. We shall need better organization for the transition to peace than we had in mobilization for war if we are to avoid needless unemployment, loss of production, and frustration of business enterprise.



President, McGraw-Hill Publishing Company, Inc.

FACTORY
MANAGEMENT AND MAINTENANCE
· C · MORROW · EDITOR

Produce—But Also Plan Ahead

There is no gainsaying the need for industry to produce war materiel. The over-all requirements of the armed services have not been cut back appreciably. They will not be for the first half of the year, and probably not for the second half. So production is a first lien on every plant's manpower, time, and production capacity.

But the make-ready work that took up so much of the plant operating men's time two years ago—even last year—is largely done. Relatively, production is on an even keel. There is no reason why brainpower should not be used to plan for transition from war to peace output and for post-war operation. Some of the things that need to be done are suggested here.

1. At contract termination, each plant will have to know where its production stands. Records will have to show accurate inventories of raw materials, parts in process, completed units, government-owned and company-owned equipment. Not knowing these things will greatly retard transition. This job *must be begun now.*

2. To be in the best position to carry on post-war activities, each company should be deciding now what personnel and what equipment it is going to keep.

3. In the interest of economical production, plant layout flexible enough to handle a wide range of permissible quantities of the post-war products can be planned now. Most plants are not going to jump suddenly into economical-lot manufacture.

4. Basic standards can be agreed upon and fully understood by all key personnel. Included would be quality standards, performance standards, machining times, and allowances.

5. Materials handling plans can be made, and in many cases the equipment can be selected for the post-war work.

6. Each company can set up a procedure of co-operation between operating departments on the one hand, and engineering and design departments on the other, to be ready for the most effective use of new materials and processes.

I discuss probable post-war needs with a good many people. Most of them are convinced that low-cost production resulting from efficient plant operation is going to be paramount. With me, that conviction is a creed—one that I hope industry will help put into effect by following the six procedures outlined here.

J. C. Morrow

WHEN CONTRACTS

Eight Reasons Why Industry Must Act Now

1 **Contract termination is a job for today and a job for tomorrow.** It is a job of planning for companies which, as yet, have had no cancellations; it is a job of action for those that have.

Eventually, of course, termination will affect virtually every war contractor. The sooner each company makes adequate preparation, therefore, the better it will fare when the real rush comes.

True enough, contracts having a face value of $10,000,000,000 have already been terminated without apparent great loss or damage. But these cancellations have hit only a fraction of industry's backlog of war orders and there have been plenty of other war orders to take their place.

It will be quite another matter if industry is suddenly faced with wholesale, *final* cancellations of contracts totaling $20,000,000,000 or $30,000,000,000. What will happen then? Nobody knows for sure. But *chaos* could be the result—unless both industry and government are fully prepared.

Plainly, then, management must do two things:

Get ready now for termination problems of the future, and Act promptly and correctly on these problems as they arise.

2 **The race is always to the swift.** The war has shown that, whenever industrial logjams develop, priorities become necessary. This can happen in a jam-up of termination claims, too. If there is only one seat left on a bus and two men try to board it, which one gets the seat—the one who has his tickets and correct change all ready or the one who stands and fumbles in his pockets? It stands to reason that the best-prepared companies will be served first in contract termination. The least-prepared companies will be the ones that "miss the bus."

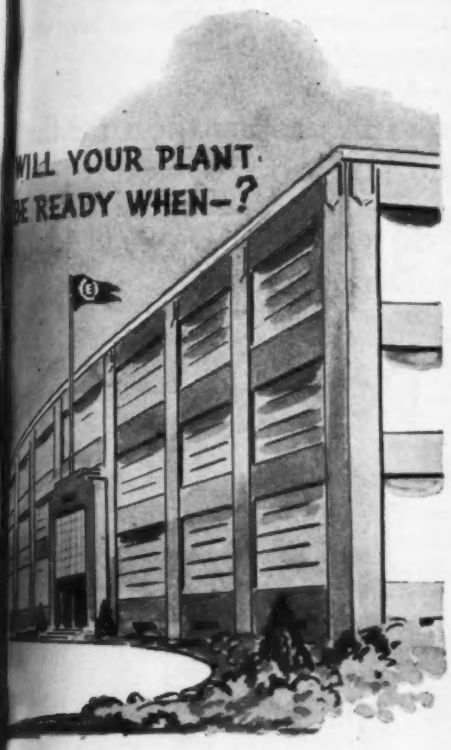
3 **The cost of missing the bus may be great.** How can a company get back to peacetime production promptly if its working capital is tied up in delayed contract settlements? That company may lose its place in the competitive sun and be almost literally "frozen to death" while more alert or more fortunate competitors capture its markets.

4 **The Lord helps those who help themselves.** Contracting officers are human and generally reasonable, but they are also conscious of the watchful eyes of investigating Congressmen. And it is certainly no part of their duty to go a single step out of their way to see that a company gets all that is due it. On the contrary they would be liable to fines and imprisonment, as the law stands now, for so assisting a contractor.

In one known instance a company submitted a claim that was $750,000 lower than the amount it could have got if the claim had been properly drawn and presented.

'S END

A Guide to Termination



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That was the frank opinion of the contracting officers.

Moreover, contracting officers may get much more "tough" as time goes by. Right now government *needs* industry, so management is operating in a seller's market. Later that psychology will change. Some contracting officers may then try to make records for themselves by driving the hardest possible bargains. Finally, as war enthusiasm wanes, many Congressmen will make a practice of attacking industry—to which industry's best answer will be a sound, factual defense based on a record of reasonable dealing with the government on the government's own terms.

5 **There is nothing simple about contract termination.** The over-all formula for settlement is now fairly clearly defined. The government will pay for finished articles at the contract price and for actual costs plus a reasonable profit on work done up to the time of termination.

There is nothing simple about procedure, however, and there never will be. All claims against the government, after all, are bound to be surrounded by safeguards. That means—inevitably—red tape. There is no use bewailing it. There is every use in setting up procedures that will conform closely with those of the government.

Most termination cases will be settled, remember, by *negotiation*. And the most successful parties to negotiation are likely to be those that present the most *facts* in the most understandable manner.

6 **The pattern of procedure is just about set.** Congress is still considering bills on contract termination. But legislation is more likely to affect policy than procedure. Congress has talked, for example, of making advance payments to contractors mandatory on presentation of claims. There has also been talk of taking jurisdiction over contract settlement from the armed services and vesting it in a civilian agency.

Don't bank on either. The known fact is that the uniform termination article proposed by Bernard M. Baruch and approved by Director James M. Byrnes of

the Office of War Mobilization has given a fairly definite form to the procedural pattern. The Baruch article, which largely confirms the procedures set forth in the War Department's Procurement Regulation 15, is probably here to stay. It will be augmented, of course, by additional OWM rulings on points yet to be cleared up.

7 **Everybody must get in and pitch.** Any company that has war business, whether it be a prime contractor or a tenth-tier subcontractor, will sooner or later be involved in the scramble for settlement of claims. Nobody can afford to shrug off the job as "something for the financial officials of the prime contractor to worry about."

There is every likelihood that the chain of responsibility for preparation of claims will be forged more firmly from prime contractor to subcontractor, to subsubcontractor, which means that failure of any link in the chain will delay payment for those behind it.

Termination settlement is thus not a job for one contractor but for all contractors. And it is not just a job for financial executives. Both operating and supervisory managements are very likely to be drawn into it in every department involved.

8 **Adequate preparation for contract termination is a definite management obligation.** Once it was industrial management's patriotic duty to get into war production. There is now an equal obligation on management to do its part to "win the peace" by swinging swiftly into peace-goods production, when the time comes, and thus providing employment in the post-war period. To the extent that contract settlement may hasten or delay this process, management is responsible for keeping its accounting house in order.

For all the above reasons, this article has been prepared to help management by pointing out:

Steps to take in preparation for the termination job.

Things to do when "T-Day" (Termination Day) arrives.

Why Preparation Will Pay

1. Companies that present well-prepared, factual claims will receive payment most promptly, be best able to resume peacetime production quickly, maintain markets, provide jobs

2. Events will forge more firmly than ever the chain of responsibility from contractor to subcontractors and subsubcontractors and vendors for preparation and settlement of claims

3. Accurate inventories will be the basis for most successful settlements. Contractors should carry records of all government-owned materials, machinery, and tools related to a contract

4. It will pay contractors to decide in advance what items they would like to retain, what price they can pay, what items they can sell readily, and what prices they can obtain

5. Most settlements will be arrived at through negotiation. And the most successful parties to negotiations are usually those that present the most facts in the most understandable way

6. Just as it once was industry's duty to get into war production, now it is up to management to prepare for termination and avoid the unemployment which delay may cause.

How to Get Ready for Contract Termination

Familiarize Yourself With the Problem

1. Arrange through local officers of the procurement agencies with which you do business to obtain copies of all pertinent regulations, booklets, bulletins, and directives concerning termination, as they appear.

2. Build a library of general and specific information on the topic. (For a basis see "Required Reading" in the adjoining column.)

Organize for the Future

1. In each company a responsible official should be designated to head up the contract termination job. (Some companies have already given to such executives the title of vice-president in charge of contract termination.) This official should begin now to choose the department heads who will work most closely with him and, where necessary, engage personnel to assist him on his own staff. A good example of a company set-up is that of the Sperry Gyroscope Company (see organization chart on following page).

2. Channel information regularly to all interested accounting and operating executives throughout the organization. Analyze and digest government manuals and regulations in brief form and interpret them in their application to your company and its contracts. Make sure, for example, that the procedural distinctions between types of contract—negotiated prices, cost-plus-fixed-fee, and lump sum—are fully understood. Keep track of news events relating to the topic, such as Congressional debates on legislation, statements of War Department and other officials, etc. It may prove advisable to issue company bulletins to keep executives currently informed. In this connection your advertising manager and his staff can be utilized to advantage.

3. Prepare instructions for department heads, subcontractors, and vendors, outlining action to be taken in event of cancellation. Prepare also forms, letters, and telegrams of notification and keep them up to date.

Check Your Cost Accounting Procedures

1. Determine whether or not you can, at any time, break down costs of (1) materials, (2) direct production labor, (3) indirect factory expenses, (4) administrative expense, and (5) unamortized charges on special equipment—**as they apply to the specific contract at any stage of production.** Such detailed data may not always be needed, of course, especially on contracts under $50,000. Discuss the probabilities with procurement officers or (if you are a subcontractor) your prime contractor. A good sample of the sort of data which subcontractors are expected to file is given in the Sperry Gyroscope Company's audit forms which are reproduced on pages 92 and 93.

REQUIRED READING

Procurement Regulation No. 15. The War Department manual on contract termination procedure

Procurement Regulation No. 7. Covering disposition of property.

War Department Termination Accounting Manual for Fixed Price Supply Contracts

Contractors' Guide to Current Regulations, Policies, and Procedures. In preparation by the Readjustment Division of the Army Service Forces

Control Systems for Minimizing Commitments, Work in Progress, and Inventories. Published by the Ordnance Department, Washington, D. C.

Effective Control of Terminated Government Contracts as Practiced by Sperry Gyroscope Company. A publication of Remington-Rand, Inc., Buffalo 3, N. Y.

Copies of Procurement Regulations 15 and 7 and the Termination Accounting Manual may be obtained by addressing Superintendent of Documents, Government Printing Office, Washington, D. C. The price of the first two is 20 cents per copy; of the third, 25 cents. Both P.R. 15 and P.R. 7 are in process of revision. The revisions are appearing in the Federal Register.

2. Try your own "test checks" and "dress rehearsals" on existing contracts to see how accurately and quickly you can gather the data described above.

3. Analyze the cost of getting these data and set up a separate account for them. The costs can be charged as part of the cost of termination.

Examine Your Production Control and Inventory Methods

1. See if you can readily check your inventories of materials, finished products, goods-in-process, and parts in relation to a specific contract at any stage of production.

2. Make sure you are not carrying disproportionately large inventories in relation to the size of the contract, and also that your orders to subcontractors and vendors do not

exceed contract requirements except as overage may be specially approved by contracting officers.

3. Carry record of government-owned materials, machinery, and tools in such form that those related to the contract may readily be identified and segregated.

(For analysis of Ordnance Department program see "A Control Plan to Speed Output, Ease Contract Termination," by Maj. W. R. Comber, FACTORY, November, 1943.

Check Termination Provisions of Your Contracts

1. See that all contracts are in order and consistent with other contracts and purchase orders relating to the same job. Uniform termination provisions are highly desirable. Contracting officers are trying to insert the "Baruch article" on termination (see Pages 96 and 97) in existing contracts where possible. Prime contractors may ask for insertion of this article, if they wish it, and may then extend similar termination provisions to their agreements with subcontractors and vendors.

2. Make sure that all contract changes, such as changes in specifications and other modifications, are finalized and not left in a quasi-settled state. Obsolete inventory, arising from questions on this point, are considered a primary delaying factor in settlement. It is also regarded as advantageous for prime contractors to have Letters of Intent and other informal commitments exchanged into formal contracts.

Examine Your Company's Financial Position

1. Try to visualize all the sudden stringencies that may result from termination and erect safeguards against them.

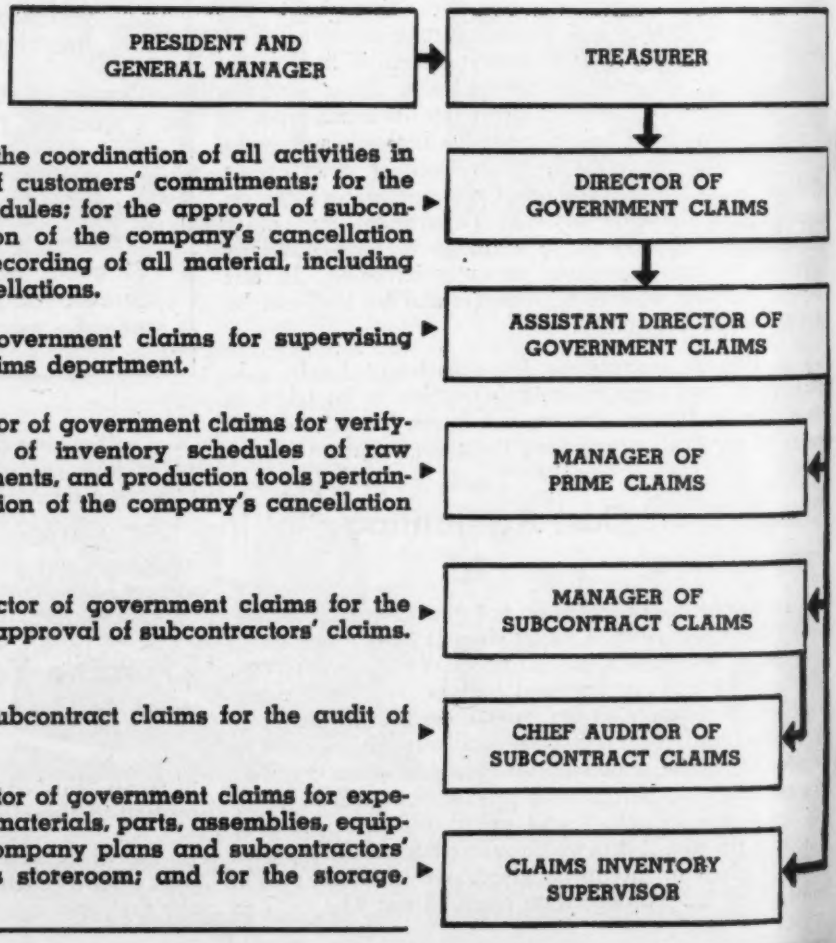
2. Study your backlog of orders and try to estimate where and when terminations are likely to occur in the greatest volume. A conference with contracting officers can sometimes help to form a forecast.

3. Confer with your bankers and explore the possibility of arranging for "V-T Loans" and other forms of interim financing.

4. Challenge the advisability of submitting any termination claim in connection with a given contract. There will be instances in which a claim will be more trouble than it is worth—in view of excess profits taxes and possible renegotiation of prices. If no claim is submitted, contractors may keep non-critical materials involved for their own use or sale in any way consistent with WPB and OPA regulations. There may also be wisdom in submitting claims for costs alone, making no claim for profits. Such claims go through speedily and free the facilities involved for the contractor's own use.

How Sperry Organized

***THIS CHART** illustrates major factors in effecting contract terminations and settlements. Smaller organizations might advantageously combine some of the steps.*


PRESIDENT AND GENERAL MANAGER
TREASURER
Responsible to the treasurer for the coordination of all activities in connection with the cancellation of customers' commitments; for the review and approval of claim schedules; for the approval of subcontractors' claims; for the preparation of the company's cancellation claims; and for the storage and recording of all material, including drawings, pertaining to such cancellations.
DIRECTOR OF GOVERNMENT CLAIMS
Responsible to the director of government claims for supervising the activities of the government claims department.
ASSISTANT DIRECTOR OF GOVERNMENT CLAIMS
Responsible to the assistant director of government claims for verifying the applicability and pricing of inventory schedules of raw materials, parts, assemblies, equipments, and production tools pertaining to claims; and for the preparation of the company's cancellation claims.
MANAGER OF PRIME CLAIMS
Responsible to the assistant director of government claims for the audit, negotiation, and preliminary approval of subcontractors' claims.
MANAGER OF SUBCONTRACT CLAIMS
Responsible to the manager of subcontract claims for the audit of subcontractors' claims.
CHIEF AUDITOR OF SUBCONTRACT CLAIMS
Responsible to the assistant director of government claims for expediting the transfer of claimable raw materials, parts, assemblies, equipments, and production tools from company plans and subcontractors' premises to the government claims storeroom; and for the storage, recording, and shipment thereof.
CLAIMS INVENTORY SUPERVISOR

How International Harvester Organized for Termination

1 Head office committee (a) notifies branch plants and, through them, subcontractors; (b) gets in inventories and claims from all; (c) handles negotiations and final settlements; (d) directs staff of trained "termination expediters" in field, who visit subs and assist them in preparing claims.

2 Branch plant (a) notifies subcontractors; (b) gets in acknowledgements; (c) ascertains which will file claims; (d) sends out instructions and forms; (e) reports to head office; (f) tells subs their remaining negotiations will be with the head office.

3 Branch plant also (a) makes own inventory; (b) prices it out; (c) recommends disposition of tools and materials, (d) compiles its own cost claims; (e) sends them to head office.

4 Subcontractor (a) gets notice from branch plant; (b) announces intention of filling claim; (c) receives instructions and forms; (d) deals directly thereafter with head office in preparation and settlement of claims with aid of expediters.

AN INSTRUCTIVE CASE in preparation for contract termination is provided by the International Harvester Company with 12 branch plants in different localities.

Termination responsibility is centralized in a head office committee including a chairman—in this case the manager of credit and collections—a vice-chairman, his principal assistant, a chief auditor, a legal representative, an engineer, and a warehousing executive.

Also members of the committee, as far as their own plants are concerned, are the branch plant superintendents and plant auditors. With a branch plant production man and a stores man, they constitute a local subcommittee.

The procedural routine is indicated in the chart above. Note that all final questions of disposition of property and settlement of claims come together in the hands of the head office committee. Note also the liaison between the head office committeeman and his branch plant counterpart: accountant with accountant on costing; production man with production man on tooling; stores man with stores man on inventories.

The "termination expediters" 15 in number, are company credit men who were given special training at the head office. From their field stations they can be sent to help subcontractors with inventories and claims.

Continued on Next Page

What Steps to Take When Termination Comes

Stop Work as Directed

1. Make no further deliveries of completed items and make sure that every department of the company involved is notified at once.

2. Cease all procurement relating to the terminated item. **Notify subcontractors and vendors by telegram, followed by letter, and obtain acknowledgements from them.** Importance of this is emphasized by the fact that no charges will be paid on work done or costs incurred (except termination costs themselves) after the formal termination date. On exceptional occasions, contracting officers may agree to postpone the termination date or arrange for continuation of a portion of the contract if it can be shown that such action is advantageous to the government —i.e., if a large number of items are virtually finished and can be completed quickly at small cost to the government.

Take Inventory

1. Include in inventory all finished goods, work-in-process, parts, supplies, machinery, and tools directly related to the contract and segregate those belonging to the government.

2. Determine the value of these inventories.

Get Transfer and Handling Instructions

1. Contact the contracting officer (or, if you are a subcontractor, contact the prime contractor) for instructions as to the transfer and handling of all government-owned materials, goods, and equipment (also plans and blueprints) making sure that they are properly protected in the meantime.

2. Decide which of these items you would like to retain, what price you can pay, what items you believe you can sell readily and what prices you believe you can obtain for them.

Prepare Claims

1. Make sure, if you are a prime contractor, that all subcontractors have acknowledged notice of termination. Ascertain which will file claims and which will not. Then forward to those who plan to enter claims a request for a detailed statement of inventories and costs. Remind them that claims must be fully supported by facts and may be subject to government audit. Well prepared prime contractors will have forms already set up for the use of subcontractors and vendors.

2. Get in claims, review them, and get approval of the contracting officer for their payment. When claims are settled, the prime contractor is ready to negotiate his final settlement with the government.

3. Get in claims, if you are a subcontractor, from sub-subcontractors and vendors and prepare them for submission to the prime contractor. Well-prepared subcontractors who have taken the steps outlinesd in "How to Get Ready for Termination" (Pages 85 and 86) should be able to supply needed data quickly in any form requested.

4. Dispose of government-owned materials and equipment as provided in instructions from contracting officer.

5. Prepare a record of post-termination costs—i.e., cost of preparing claims themselves, for inclusion with claims. No payment will be made on "guesswork" here but every reasonable charge for which there is adequate record will be honored. Time records should be kept of the work done by individual personnel on specific contract termination cases. These records should be summed up weekly and monthly and translated into dollars of direct labor cost at the hourly payment rate of the individuals. **Remember: It is on the basis of these direct costs that the indirect costs of termination are computed on a percentage basis.**

Negotiate Final Settlement

1. Bear in mind that, regardless of regulations, formulas, and even legislation, the great majority of claims will continue to be settled by common-sense discussion over the table. It is in the nature of things that negotiation always implies some discussion, some doubt, and some disagreement. It follows, then, that that company will fare best which is represented by skilled negotiators fully armed with facts and figures concisely prepared in a form that is readily understood.

TRAINING IN TERMINATION

Industry and the armed services are going to school together to study contract termination procedure. In the Chicago Ordnance District recently, 200 men, half of them army officers, the other half from industry, went through a 3-day lecture session. Similar courses are being held in New York, Detroit, and Philadelphia.

An over-all training course is now in preparation at the Washington Headquarters of the Readjustment Division, Army Service Forces, for use throughout the country. Within companies and at conventions of industrial associations, informal courses and seminars are also being instituted.

What Each Department Does

Suggested by National Electrical Manufacturers Association

CONTRACT TERMINATION DEPARTMENT
(Or Designated Executive)

1. Coordinate and supervise program.

2. Provide over-all follow-up to insure prompt and complete action of departments involved.

3. Submit claims and supervise negotiations for settlement, including arrangements for advance or partial payments.

SALES DEPARTMENT

1. Receive termination advice from customer and clarify any doubts as to exact terms of the termination notification.

2. Request of customer any desired adjustment of price or terms and conditions on portion of the contract not terminated.

3. Originate promptly the internal termination notice and advise personnel and departments affected by the change.

PURCHASING DEPARTMENT

1. Discontinue making of subcontracts and purchase orders for materials, parts, and soforth, relating to terminated portion of the contract.

2. Terminate unperformed or partially performed subcontracts and purchase orders relating to terminated portion of the contract.

3. Give notice of termination to subcontractors and vendors and have them give similar notice in turn to those affected.

4. Review termination claims of subcontractors and vendors in cooperation with accounting and other appropriate departments, and effect settlement of such claims subject to any necessary government approval.

ACCOUNTING DEPARTMENT

1. Cooperate with purchasing department in review of claims of subcontractors and vendors.

2. Prepare termination claim and all required supporting schedules for submission to customer.

3. Segregate inventories as follows: (a) Completed units (finished goods), (b) raw materials on hand, (c) purchased parts, (d) shipping containers purchased for performance of contract, (e) work-in-process, (f) tools, dies, jigs, fixtures, designs, drawings, etc.

4. List inventory items in complete detail, showing location, quantities, description, costs, and disposal prices. Tag inventory items with reference to terminated contract or order number, mentioning government department or customer involved with note that, unless such items are excluded from termination claim, they can be disposed of only with approval of government.

PRODUCTION DEPARTMENT

1. Arrange for completion of continued portion of contract.

2. Take all necessary steps to stop work on the terminated portion of the contract as promptly as possible after termination date.

3. Prepare inventory of property allocable to terminated part of contract.

4. Take action to prevent loss or damage to property to be included in a termination claim.

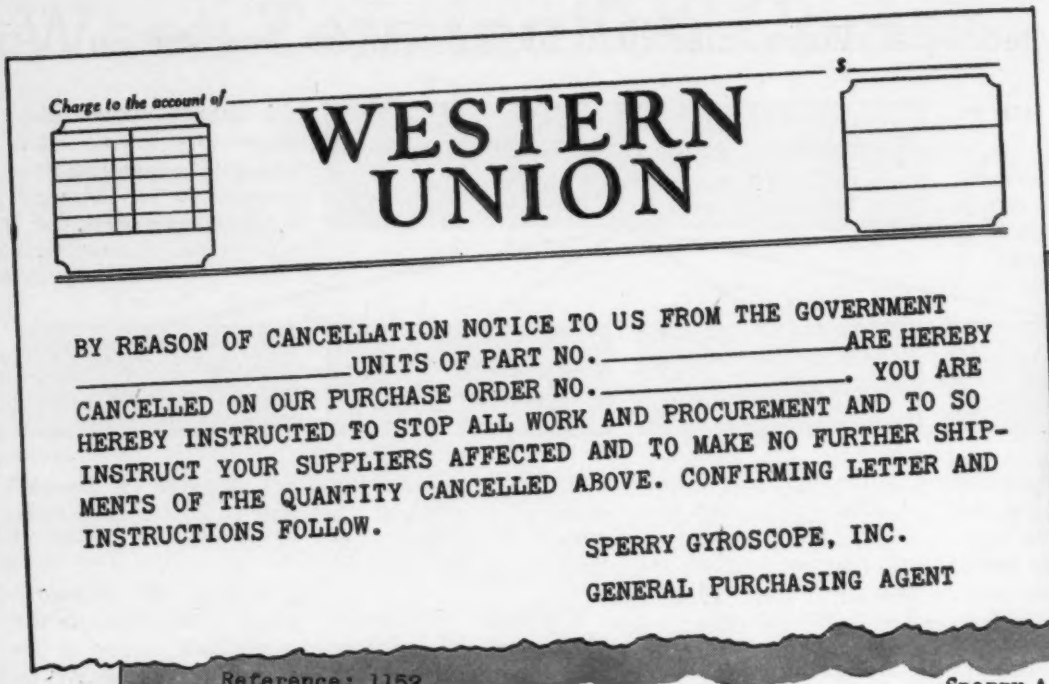
5. Issue necessary instructions to purchasing department with respect to discontinuance and termination of subcontracts, and orders for parts, raw material, etc., applicable directly or indirectly to terminated portion of contract.

6. Initiate appropriate steps with proper departments with respect to leased equipment and facilities rendered inactive as result of termination notice.

(This departmental breakdown of responsibilities is suggested by National Electrical Manufacturers Association. NEMA points out, however, that companies and their problems vary widely and that charts of this sort should be regarded only as suggested typical plans and not as hard-and-fast recommendations to cover all companies.)

CONTINUED ON NEXT PAGE

How Sperry Notifies Its Subs of



Charge to the account of

$

WESTERN UNION

BY REASON OF CANCELLATION NOTICE TO US FROM THE GOVERNMENT _____ UNITS OF PART NO. _____ ARE HEREBY CANCELLED ON OUR PURCHASE ORDER NO. _____. YOU ARE HEREBY INSTRUCTED TO STOP ALL WORK AND PROCUREMENT AND TO SO INSTRUCT YOUR SUPPLIERS AFFECTED AND TO MAKE NO FURTHER SHIPMENTS OF THE QUANTITY CANCELLED ABOVE. CONFIRMING LETTER AND INSTRUCTIONS FOLLOW.

SPERRY GYROSCOPE, INC.

GENERAL PURCHASING AGENT

Reference: 1152

Sperry A.O.'s

Subject: Confirmation of Telegraphic Notice of Cancellation

Attention:

Gentlemen:

1. As a result of our receipt from the United States Government of a notice of termination relating to certain of our contracts with the Government, we instructed you by telegram on 194 , to stop all work and procurement on certain Purchase Order(s) chargeable to such Prime Contracts with the Government, as of the date of your receipt of such telegram and we terminated as of such date the Purchase Order(s) listed below to the extent of the quantities indicated:

P.O. NO.	PART NO.	QUANTITY CANCELLED

2. We also confirm our instructions that you terminate all your commitments with your suppliers for such portion of the materials or services as are applicable to the portion of the Purchase Order(s) terminated as detailed in Paragraph 1 above.

3. Make no further shipments on account of the terminated portion of the above Purchase Order(s): all related materials, work in process, and finished parts should be segregated and preserved in good condition at your plant pending our further instructions.

4. All materials, parts, tools, jigs, dies, patterns, test equipment, blueprints, operation sheets, etc. furnished (or paid for) by Sperry for use in connection with the terminated Order(s) and released by such termination should be properly stored and held for us pending our further instructions.

5. If the subject purchase order is for Class "A" products, the CMP allotment originally extended to you by us is hereby cancelled to the extent of this modification. The unused portion of said allotment must be reported to us immediately on Form CMP-32.

Omaha Public Library
Reference Dept.

Page 2.

6. Any claims made by you will be subject to Government approval and may be subject to Government audit. Settlement will be conditioned on a strict compliance with all instructions issued in connection with this termination.

7. Please have a principal officer or partner, as the case may be, of your company sign the enclosed carbon copy of this letter at the point indicated thereon, stating whether or not any claim for cancellation charges will be filed by you as the result of this cancellation and return it to:

Sperry Gyroscope Company, Inc.
Attention: Government Claim Department
Manhattan Bridge Plaza
Brooklyn (1), New York

8. If any cancellation claim is to be filed, we will send you upon receipt of your knowledgement complete instructions and forms for the preparation of your claim.

Very truly yours,

SPERRY GYROSCOPE COMPANY, INC.

By_____
J. J. Wilson
General Purchasing Agent

Omaha Public Library
Reference Dept.

To Sperry Gyroscope Company, Inc.

The original of the above letter was received by us on , 194 .

(a) There will be a charge for costs incurred in connection with the termination of the Purchase order(s) listed in said letter.

(b) There will not be a charge for costs incurred in connection with the termination of the purchase order(s) listed in the above letter, and in consideration of the receipt of $1.00 and other good and valuable consideration, we hereby release Sperry Gyroscope Company, Inc. from any and all claims arising out of such termination of such purchase order(s).

Please state the position held by the officer or partner of your company signing below and set forth the date upon which and the place at which he signed.

Company_____

By_____

Title_____

Dated_____
City & State

Opening gun is the telegram which goes out over the signature of the purchasing agent to all vendors appearing on lists previously prepared by the production control department and checked by the purchasing department. Next comes the confirming letter, which is sent in duplicate to all vendors. Acknowledgment form at end of letter is filled out by the vendor on the duplicate copy and returned to Sperry. It shows whether or not vendor will file a claim. (From: "Management Controller No. 697." supplement to "Effective Control of Terminated Government Contracts as Practiced by the Sperry Gyroscope Company," a publication of the Systems Division, Remington-Rand, Inc., Buffalo 3, N. Y.)

Continued on Next Page

SUMMARY OF TERMINATION CHARGES

PAGE 1

TO-SPERRY GYROSCOPE COMPANY, INC., BROOKLYN 1, N. Y.

Date of this Statement_____

IMPORTANT { As copies of this form will be submitted to government contracting officer, with our recommendation, please fill in as requested. Prepare five copies of this summary, retaining one for your records. List termination charges on cancelled portion only — do not include charges for uncancelled portion (if any). } **IMPORTANT**

STATEMENT BY: (Subcontractor's Name and Address)

Sperry P.O. No./S.

Part No./S. on Above P.O./S.

Subcontractor's Ref. No. Sperry Reference No.

Fill in proper amounts on those lines for which you have termination charges, otherwise, write in "none".

	ITEM	AMOUNT IN $	INSTRUCTIONS
1	WORK IN PROCESS		See Page 2 Attached, Section "B"
2	UNPROCESSED PURCHASED PARTS		See Page 2 Attached, Section "C"
3	UNPROCESSED RAW MATERIALS		See Page 2 Attached, Section "D"
4	TOOLING, ENGINEERING AND/OR OTHER COSTS		Attach explanation of nature of cost, indicating gross amount and basis for inclusion of portion thereof in your termination charges. Do not charge if included in items 1 or 5.
5	GENERAL AND ADMINISTRATIVE EXPENSE		Attach explanation of basis of allocation and show relationship of expense allocated to expense incurred.
6	TERMINATION CHARGES FROM YOUR SUPPLIERS		Attach list of your suppliers' names, addresses, amounts, and explain applicability to cancelled portion. Do not include any amounts included elsewhere on this summary.
7	NET PROFIT FOR WORK ON TERMINATED PORTION		Attach explanation of basis of computation and state rate of profit indicated if order/s had been completed.
8	COMPLETED UNITS ON HAND AT PURCHASE ORDER PRICE		See page 2 attached, section "A". Include only those units applicable to terminated portion and which are ready for shipment.
9	EXPENSES INCURRED AFTER TERMINATION		Attach explanation of expenses incurred.
10	TOTAL TERMINATION CHARGES		**Indicate Here The** **Dollar value of material, parts, etc. not included above, which you diverted to other uses at 100% of your cost.**

ALL AREAS INDICATED THUS [ ] MUST BE FILLED IN ON BOTH PAGES OF THIS SUMMARY.

The undersigned certifies that work stopped at its plant on the terminated portion of the above Purchase Order(s) on [ ] and that no costs or expenses subsequent to that date are included above, except as so indicated, and that the termination instructions were issued to its suppliers on [ ]

The undersigned also certifies that, to the best of its knowledge and belief, the above Summary of Termination Charges with respect to the above Purchase Order(s) with the Sperry Gyroscope Company, Inc., prepared for submission to said Sperry Gyroscope Company, Inc. and to Contracting Officers acting in behalf of the United States of America, is true and correct, as itemized in the above summary and supporting schedules and explanations, has been prepared from the books of account and records of the undersigned in accordance with recognized accounting practices, includes (so far as costs are involved) only those costs necessary for the performance of said Purchase Order(s), and the charges as stated are fair and reasonable. The undersigned makes this certificate with full knowledge that the above Summary of Termination Charges will be used as a basis for a settlement with the undersigned and that the amount of such settlement may be included in a claim for reimbursement under a contract with the United States of America.

SIGNED AND ACKNOWLEDGED BEFORE ME

THIS _____ DAY OF _____ 194

Notary Public

SUBCONTRACTOR'S FIRM NAME

SIGNATURE _____ TYPE NAME

President, Vice President, Treasurer, Asst. Treasurer

SIGNATURE _____ TYPE NAME

Chief Accounting Officer

In addition to being notarized, this form must have two signatures as indicated above.

HOW SPERRY CHECKS ITS SUBCONTRACTORS' CLAIMS — This form provid

SUMMARY OF TERMINATION CHARGES — SCHEDULES SUPPORTING SUMMARY

PAGE 2

TO-SPERRY GYROSCOPE COMPANY, INC., BROOKLYN 1, N. Y.

Date of This Statement

In addition to being notarized, this form must have two signatures as indicated above.

SUMMARY OF TERMINATION CHARGES — SCHEDULES SUPPORTING SUMMARY

PAGE 2

TO-SPERRY GYROSCOPE COMPANY, INC., BROOKLYN 1, N. Y.

Subcontractor:

Sperry P.O. No./S.

Part No./S. on Above P.O./S.

Date of This Statement

Fill in regardless of extent of claim — fill in status as of date of this statement

	Sperry Part No.	Sperry P.O. No.	Quantity Ordered	Quantity Cancelled	Quantity Not Cancelled		Last 3 Shipments	
					Shipped	Unshipped	Date	Quantity
GENERAL DATA								

EDITOR'S NOTE: Actual form is 8x11 inches. Sections A, B, C, & D below are somewhat deeper than as shown here

Omaha Public Library
Reference Dept.

1. If you have any material, tools, etc., furnished (or paid for) by Sperry applicable to the terminated portion, indicate date you sent us a list of such items.
2. The government requires that we obtain your recommendation for the disposal of materials, parts, etc., included in your termination charges. Therefore, you must attach such recommendations, stating extent of your efforts to divert to other orders and/or obtain best prices available, time limit and other qualifications of disposal offers. If scrap, indicate weight, composition and price.

Where is this information shown?

Do not dispose of any material without first obtaining Sperry approval.

THE INVENTORIES LISTED BELOW ARE LOCATED AT _____ Street _____ City _____ State

Quantities on hand should be determined by actual count and should be segregated.

Fill in only sections applicable to your charges

A Completed Units on Hand for Terminated Portion	Sperry Part No.	Sperry P.O. No.	Sperry Part Name	Completed Units on Hand Applicable to Cancelled Portion	Date Completed	Unit Price On Sperry P.O.	Amount

List the individual applicable component items on hand. Segregate by Sperry-ordered part number.

B Work in Process — Including Component Finished Parts	Component Part No. Prefix Sperry No. with 'S'	Part Name	Total Quantity Required for Cancelled Portion	Quantity on Hand for Cancelled Portion	% of Completion Based on Man-Hrs. (See 1 Below)	Material	Direct Labor	Factory Overhead (See 2 Below)	Total Factory Cost

If the above space is not sufficient, please attach list of work in process inventory (applicable only to terminated portion) on sheets with the above columnar headings.

1. If man-hour basis is not practicable, use a more appropriate basis and explain.
2. Attach explanation of basis of allocation and show relationship of overhead allocated to actual overhead incurred.

C Unprocessed Purchased Parts	Component Part No. Prefix Sperry No. with 'S'	Part Name	Total Quantity Required for Cancelled Portion	Quantity on Hand for Cancelled Portion	Unit Cost	Your P.O. No.	Purchase Amount	Handling Charge (See 3 Below)	Total Cost

If the above space is not sufficient, please attach list of unprocessed purchased parts inventory (applicable only to terminated portion) on sheets with the above columnar headings. 3. Attach explanation of basis of calculation and show relationship to actual handling expenses incurred.

D Unprocessed Raw Materials	Description — Size	Total Quantity Required for Cancelled Portion	Quantity on Hand for Cancelled Portion	Unit Cost	Your P.O. No.	Purchase Amount	Handling Charge (See 3 Above)	Total Cost

See instructions above for unprocessed purchased parts.

Continued on Next Page

VOLUME 102, NUMBER 3 · MARCH, 1944

provides clues to data subcontractors must furnish in support of charges

Questions and Answers

Renegotiation

Are profits on canceled contracts subject to renegotiation?

Yes, but only as they are merged in a company's annual profit-and-loss statement on war work

Ahead of Schedule

If a contractor is ahead of schedule on a contract at the time of termination, will he be paid?

Yes. He will be reimbursed for completed items and for other costs according to standard termination procedure. There is wisdom in the warning that contractors should make prompt delivery of items as completed, however. Accumulated inventories of finished goods—which the government is **not** required to inspect, accept, and pay for at the unit price stated in the contract—have been the cause of some delay in settlement.

Subcontractors

Can contractors compel subcontractors to submit their claims to government audit if they, themselves, are not satisfied with the claims?

Yes. When a prime contractor does certify a claim he is, in effect, assuring the government that he has reviewed it with the same care with which a prudent individual would disburse his own money. The government can, and may, make him prove this. If he is dissatisfied with a subcontractor's claim, it is to his advantage to forward that claim to the contracting officer with his comment as fast as possible.

Book vs. Physical Inventory

When is a "book" inventory adequate for termination purposes?

A book inventory is considered appropriate for preliminary termination procedure, but a physical inventory must be taken for purposes of final negotiation. Contractors should be able to report not only on the results of their inventory but also on the exact method by which it was taken.

Promptness

What are the advantages of prompt preparation and submission of claims?

They are even greater than they appear. There is, first of all, the old principle of "first come, first served." There is additionally—and perhaps more importantly—the psychological good effect of promptness. If contracting officers are kept waiting for claims, they may humanly begin to suppose that the delay is due to poor management or to an elaborate attempt to "build up" the claim. In either case, the more time that goes by, the more closely are claims likely to be scrutinized. This can have the effect of throwing what might have been a "spot check" over into a more time-consuming detailed audit; or it might deepen suspicion of fraud, if any existed, to the point where the matter would be passed to the General Accounting Office for review.

The Time Element

How much time do settlements generally require?

The elapsed time between presentation of claims and settlements has averaged about 17 weeks. Some manufacturers have complained of "red tape" and delay. The War Department has a comeback for this. It says that, of all the cases that remain unsettled after six months, an average loss of four months' time has been due to the failure of contractors to get in their claims.

Amount of Settlements

Are contractors collecting the amounts claimed in full?

No. There are no national statistics on this point, but the comments of district procurement officers indicate that contractors are getting **most** of what they ask for. About 70 percent of basic claims (i.e., for direct labor, materials, etc.) reside in the "no dispute" area and are paid on proof. On the final claims (profits, etc.) requiring negotiation, the War Department appears to be paying about 75 percent of the amount suggested by contractors as the basis for negotiation. Experience seems to vary widely from district to district. There are districts where, it is reported, as much as 50 percent of all claims have been disallowed—at least until contractors began to improve their method of presenting claims.

Army Methods

What are industrial accountants saying about War Department review procedures?

Management men regard Army methods with real respect. The Army's review officers, they say, know their jobs, have a well-defined method, show no patience with slipshod work, and are quick to notice and question guesswork on the part of others. The scope of review procedure ranges from a quick office review to a detailed audit. The "spot check" is used to determine the general fairness of claims. Any suggestion of exaggeration usually results in a detailed audit. Any suspicion of fraud will quickly toss the case to the General Accounting Office.

Small Claims

Can small claims be settled between contractors without waiting for approval of contracting officers?

Yes. There is no rule of thumb on this, however. Some say it applies to claims of less than $5000, others set the figure a little lower.

Disposal of Surpluses

Where can contractors get help on finding buyers for surplus materials?

WPB's Surplus Materials Redistribution Division can

help if inventories are filed with it promptly on notice of termination. This same division handles the appeals of contractors who wish to retain materials left over from terminated contracts for use in the manufacture of civilian goods.

Piecemeal Claims

Is it advantageous for a contractor to present his claims piecemeal?

Yes, the contracting officers want it that way. They assert that final settlements go through much more smoothly when the underbrush has been cleared away, piece by piece, in advance. On the other hand, they deplore the tendency of contractors to seek final settlements when their claims are only half prepared.

Profit Formula

Does the Baruch article set a ceiling on profits?

No. The contracting officer is left free to negotiate a "reasonable" allowance for profit on the completed portion of the uncompleted portion of the contract. The Baruch article does include a formula—2 percent on raw material, 6 percent on costs—for use when negotiation fails. But even this is not hard and fast, inasmuch as appeals machinery exists and there is always final recourse to the common law. Most profit questions will continue to be settled by negotiation. Most contracting officers will be guided, more or less, by the company's own history of profit ratios on previous products.

Purchase of Tools

Should contractors earmark cash, or arrange loans in advance, to cover the cost of facilities and equipment which they may wish to purchase from the government in the course of winding up a contract?

Attention to this matter may be important. Careful planning is indicated, at any rate. If the purchase is made and it is used by the government as a credit, in settlement, the contractor must remember that he will still have to settle with subcontractors and vendors on a cash basis.

Explain to Labor?

Should close attention be given to explaining termination problems to labor?

Yes. The utmost care should be taken to make the explanation complete and satisfactory. The armed services dislike flare-ups resulting from shutdowns which management has made no attempt to explain to employees.

WMC Action?

What action should be taken with respect to manpower?

Management should also, on termination, notify regional offices of the War Manpower Commission of the number and types of employees which a termination may leave available for other work. This "covers" a management if it needs WMC assistance later on, to recruit additional personnel for new work.

What Costs Are Allowable

To THE EXTENT that they may be properly—and demonstrably—allocated to the contract, the following costs, in the event of termination, are allowable:

Direct labor

Indirect labor, if accurately chargeable to the contract

Materials

Supplies

Overhead, plant and company

Advertising, including institutional, about on the basis of present Treasury tax policy

Depreciation, special obsolescence, and loss of value (liberal allowance is usually made on facilities acquired specifically for performance of the contract and no longer valid for other uses)

Engineering development and special tooling relating to the contract

Research and experimental costs (as part of overhead—about in proportion to pre-war expenditures for same purpose)

Franchise and excise taxes, also declared value federal stock tax

Interest on borrowings

Special leases, including alterations and restoration of property made for performance of contract

Non-recurring initial costs

Termination costs (preparation of claims and handling and protection of government property)

The following costs are not allowed:

Severance pay to discharged employees

Employees' welfare expenditures (unless in negotiation they can be shown to have directly increased production on the contract)

Entertainment

Excessive compensations (contracting officers frown on large executive bonuses and are critical even of incentive payments)

Losses incurred through strikes

Losses incurred on other contracts

Income, excess profits, and transfer taxes

Fines and penalties

Contingency reserves

Bad debt losses and collection costs

Legal fees in company litigations

Continued on Next Page

Uniform Termination Article

★★ On this page is the uniform contract termination article devised by Bernard M. Baruch and John Hancock. Director James M. Byrnes of the Office of War Mobilization has instructed the procurement agencies to utilize this article "to the fullest extent practicable in all new war contracts."

The article clarifies much but leaves much to be clarified. It provides for payment for all completed items at contract price, permits contracting officers to make advance payments at their discretion, widens the area of their discretion in negotiation, and frees contractors from responsibility for government-owned materials and equipment 60 days after they submit inventories.

On the other hand, the article leaves largely undefined the responsibilities of subcontractors in settlement procedure and many other issues of like importance **(see "Unfinished Business," on page 99)**

THE TEXT of the Uniform Article for the Termination of Government Fixed-Price War Supply Contracts is as follows:

(a) The performance of work under this contract may be terminated by the Government in accordance with this article in whole, or from time to time in part, whenever the contracting officer shall determine any such termination is for the best interests of the Government. Termination of work hereunder shall be effected by delivery to the contractor of a Notice of Termination specifying the extent to which performance of work under the contract shall be terminated, and the date upon which such termination shall become effective. If termination of work under this contract is simultaneous with, a part of, or in connection with, a general termination (1) of all or substantially all of a group or class of contracts made by the ———— Department for the same product or for closely related products, or (2) of war contracts at, about the time of, or following, the cessation of the present hostilities, or any major part thereof, such termination shall only be made in accordance with the provisions of this article, unless the contracting officer finds that the contractor is then in gross or willful default under this contract.

Directions to Contractors

(b) After receipt of a Notice of Termination and except as otherwise directed by the contracting officer, the contractor shall (1) terminate work under the contract on the date and to the extent specified in the Notice of Termination; (2) place no further orders or subcontracts for materials, services, or facilities except as may be necessary for completion of such portions of the work under the contract as may not be terminated; (3) terminate all orders and subcontracts to the extent that they relate to the performance of any work terminated by the Notice of Termination; (4) assign to the Government, in the manner and to the extent directed by the contracting officer, all of the right, title and interest of the contractor under the orders or subcontracts so terminated; (5) settle all claims arising out of such termination of orders and subcontracts with the approval or ratification of the contracting officer to the extent that he may require, which approval or ratification shall be final for all the purposes of this article; (6) transfer title and deliver to the Government in the manner, to the extent, and at the times directed by the contracting officer (i) the fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced as a part of, or acquired in respect of the performance of, the work terminated in the Notice of Termination, and (ii) the plans, drawings, information and other property which, if the contract has been completed, would be required to be furnished to the Government; (7) use his best efforts to sell in the manner, to the extent, at the time, and at the price or prices directed or authorized by the contracting officer, any property of the types referred to in subdivision (6) of this paragraph, provided, however, that the contractor (i) shall not be required to extend credit to any purchaser and (ii) may retain any such property at a price or prices approved by the contracting officer; (8) complete performance of such part of the work as shall not have been terminated by the Notice of Termination; and (9) take such action as may be necessary or as the contracting officer may direct for protection and preservation of the property which is in the possession of the contractor and in which the Government has or may acquire an interest.

Provisions for Payments

(c) The contractor and the contracting officer may agree upon the whole or any part of the amount or amounts to be paid to the contractor by reason of the total or partial termination of work pursuant to this article, which amount or amounts may include a reasonable allowance for profit, and the Government shall pay the agreed amount or amounts. Nothing in paragraph (d) of this article prescribing the amount to be paid to the contractor in the event of failure of the contractor and the contracting officer to agree upon the whole amount to be paid to the contractor by reason of the termination of work pursuant to this article shall be deemed to limit, restrict, or otherwise determine or affect the amount or amounts which may be agreed upon to be paid to the contractor pursuant to this paragraph (c).

(d) In the event of failure of the contractor and contracting officer to agree as provided in paragraph (c) upon the whole amount to be paid to the contractor by reason of the termination of work pursuant to this article, the Government, but without duplication of any amounts agreed upon in accordance with paragraph (c), shall pay to the contractor the following amounts: (1) For completed articles delivered to and accepted by the Government (or sold or retained as provided in paragraph (b) (7) above) and not theretofore paid for, forthwith a sum equivalent to the aggregate price for such articles computed in accordance with the price or prices specified in the contract; (2) in

respect of the contract work terminated as permitted by this article, the total (without duplication of any items) of (i) the cost of such work exclusive of any cost attributable to articles paid or to be paid for under paragraph (d) (1) hereof; (ii) the cost of settling and paying claims arising out of the termination of work under subcontracts or orders as provided in paragraph (b) (5) above, exclusive of the amounts paid or payable on account of supplies or materials delivered or services furnished by the subcontractor prior to the effective date of notice of termination of work under this contract, which amounts shall be included in the cost on account of which payment is made under subdivision (i) above; and (iii) a sum equal to ——— percent[1] of the amount determined under subdivision (i) which represents the cost of articles or materials not processed by the contractor, plus a sum equal to ——— percent[2] of the remainder of such amount, but the aggregate of such sums shall not exceed 6 percent of the whole of the amount determined under subdivision (i), which for the purpose of this subdivision (iii) shall exclude any charges for interest on borrowings; (3) the reasonable cost of the preservation and protection of property incurred pursuant to paragraph (b) (9) hereof, and any other reasonable cost incidental to termination of work under this contract, including expense incidental to the determination of the amount due to the contractor as the result of the termination of work under this contract.

The total sum to be paid to the contractor under subdivisions (1) and (2) of this paragraph (d) shall not exceed the total contract price reduced by the amount of payments otherwise made and by the contract price of work not terminated. Except for normal spoilage and to the extent that the Government shall have otherwise expressly assumed the risk of loss, there shall be excluded from the amounts payable to the contractor as provided in paragraph (d) (1) and paragraph (d) (2) (i) all amounts allocable to or payable in respect to property, which is destroyed, lost, stolen, or damaged so as to become undeliverable prior to the transfer of title to the Government or to a buyer pursuant to paragraph (b) (7) or prior to the 60th day after delivery to the Government of an inventory covering such property, whichever shall first occur.

(e) The obligation of the Government to make any payments under this article: (1) shall be subject to deductions in respect of (i) all unliquidated partial or progress payments, payments on account theretofore made to the contractor and unliquidated advance payments, (ii) any claim which the Government may have against the contractor in connection with this contract, and (iii) the price agreed upon or the proceeds of sale of any materials, supplies, or other things retained by the contractor or sold, and not otherwise recovered by or credited to the Government; and (2) in the discretion of the contracting officer shall be subject to deduction in respect of the amount of any claim of any subcontractor or supplier whose subcontract or order shall have been terminated as provided in paragraph (b) (3) except to the extent that such claim covers (i) property or materials delivered to the contractor, or (ii) services furnished to the contractor in connection with the production of completed articles under this contract.

(f) In the event that, prior to the determination of the final amount to be paid to the contractor as in this article provided, the contractor shall file with the contracting officer a request in writing that an equitable adjustment should be made in the price or prices specified in the contract for the work not terminated by the Notice of Termination, the appropriate fair and reasonable adjustment shall be made in such price or prices.

(g) The Government shall make partial payments and payments on account, from time to time, of the amounts to which the contractor shall be entitled under this article, whether determined by agreement or otherwise, whenever in the opinion of the contracting officer the aggregate of such payment shall be within the amount to which the contractor will be entitled hereunder.

(h) For the purposes of paragraphs (d) (2) and (d) (3) hereof, the amounts of the payments to be made by the Government to the contractor shall be determined in accordance with the Statement of Principles for Determination of Costs upon Termination of Government Fixed Price Supply Contracts approved by the Joint Contract Termination Board, December 31, 1943. The contractor for a period of three years after final settlement under the contract shall make available to the Government at all reasonable times at the office of the contractor all of its books, records, documents, and other evidence bearing on the costs and expenses of the contractor under the contract and in respect of the termination of work thereunder.

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[1] Not to exceed 2 percent.

[2] To be established at a figure which is fair and reasonable under the circumstances.

Statement of Principles

★★ The following is the "Statement of Principles for Determination of Costs Upon Termination of Government Fixed Price Supply Contracts approved by the Joint Contract Termination Board, December 31, 1943" referred to in paragraph (h) of the Uniform Termination Article applicable to the termination of fixed-price supply contracts at government option:

1. **General Principles.** The costs contemplated by this statement of principles are those sanctioned by recognized commercial accounting practices and are intended to include the direct and indirect manufacturing, selling and distribution, administrative, and other costs incurred which are reasonably necessary for the performance of the contract, and are properly allocable or apportionable, under such practices, to the contract (or the part thereof under consideration). The general principles set out in this statement are subject to the application of any special provisions of the contract. Certain costs are specifically described below because of their particular significance, and, as in the case of other costs, should be included to the extent that they are allocable to, or should be apportioned to, the contract or the part thereof under consideration:

(a) *Common Inventory.* The costs of items of inventory which are common to the contract and to other work of the contractor.

(b) *Common Claims of Subcontractors.* The claims of subcontractors which are common to the contract and to other work of the contractor.

(c) *Depreciation.* An allowance for depreciation at

appropriate rates on buildings, machinery, and equipment and other facilities including such amounts of obsolescence due to progress in the arts and other factors as are ordinarily given consideration in determining depreciation rates. Depreciation as defined herein shall not include loss of useful value of the type covered by subparagraph (f).

(d) *Experimental and Research Expense.* General experimental and research expense to the extent consistent with an established pre-war program, or to the extent related to war purposes.

(e) *Engineering and Development and Special Tooling.* Costs of engineering and development, and of special tooling, provided that the contractor protects any interests of the Government by transfer of title or by other means deemed appropriate by the Government.

(f) *Loss on Facilities—Conditions on Allowance.* In the case of any special facility acquired by the contractor solely for the performance of the contract, or the contract and other war production contracts, if upon termination of the contract such facility is not reasonably capable of use in other business of the contractor, having regard to the then condition and location of such facility, an amount which bears the same proportion to the loss of useful value as the deliveries not made under the contract bear to the total of the deliveries which have been made and would have been made had the contract and the other contracts been completed, provided that the amount to be allowed under this paragraph shall not exceed the adjusted basis of the facility for federal income tax purposes immediately prior to the date of the termination of the contract, and provided further that no amount shall be allowed under this paragraph unless upon termination of the contract title to the facility is transferred to the Government, except where the Government elects to take other appropriate means to protect its interests.

(g) *Special Leases.* (1) Rentals under leases clearly shown to have been made for the performance of the contract, or the contract and other war production contracts, covering the period necessary for complete performance of the contract and such further period as may have been reasonably necessary; (2) costs of reasonable alteration of such leased property made for the same purpose; and (3) costs of restoring the premises, to the extent required by reasonable provisions of the lease; less (4) the residual value of the lease; provided that the contractor shall have made reasonable efforts to terminate, assign, or settle such leases, or otherwise reduce the cost thereof.

(h) *Advertising.* Advertising expense to the extent consistent with a pre-war program or to the extent reasonable under the circumstances.

(i) *Limitation on Costs Described in Subparagraphs (d), (e), (f), (g), and (h).* In no event shall the aggregate of the amounts allowed under subparagraphs (d), (e), (f), (g), and (h) exceed the amount which would have been available from the contract price to cover these items, if the contract had been completed, after considering all other costs which would have been required to complete it.

(j) *Interest.* On borrowings.

(k) *Settlement Expenses.* Reasonable accounting, legal, clerical, and other expenses necessary in connection with the termination and settlement of the contract and subcontracts and purchase orders thereunder, including expenses incurred for the purpose of obtaining payment from the Government only to the extent reasonably necessary for the preparation and presentation of settlement proposals and cost evidence in connection therewith.

(l) *Protection and Disposition of Property.* Storage, transportation, and other costs incurred for the protection of property acquired or produced for the contract or in connection with the disposition of such property.

Include These Non-Recurring Costs

2. **Initial Costs.** Costs of a non-recurring nature which arise from unfamiliarity with the product in the initial stages of production should be appropriately apportioned between the completed and the terminated portions of the contract. In this category would be included high direct-labor and overhead costs, including training, costs of excessive rejections, and similar items.

But Do Not Include the Following

3. **Excluded Costs.** Without affecting the generality of the foregoing provisions in other respects, amounts representing the following should not be included as elements of cost:

(a) Losses on other contracts, or from sales or exchanges of capital assets; fees and other expenses in connection with reorganization or recapitalization, anti-trust or federal income tax litigation, or prosecution of federal income tax claims or other claims against the Government (except as provided in paragraph 1(k)); losses on investments; provisions for contingencies; and premiums on life insurance where the contractor is the beneficiary.

(b) The expense of conversion of the contractor's facilities to uses other than the performance of the contract.

(c) Expenses due to the negligence or willful failure of the contractor to discontinue with reasonable promptness the incurring of expenses after the effective date of the termination notice.

(d) Costs incurred in respect to facilities, materials, or services purchased or work done in excess of the reasonable quantitative requirements of the entire contract.

(e) Costs which, as evidenced by accounting statements submitted in renegotiation under Section 403 of the Sixth Supplemental National Defense Appropriation Act, 1942, as amended, were charged off during a period covered by a previous renegotiation, may not be subsequently included in the termination settlement if a refund was made for such period, or to the extent that such charging off is shown to have avoided such refund.

4. To the extent that they conform to recognized commercial accounting practices and the foregoing statement of principles, the established accounting practices of the contractor as indicated by his books of account and financial reports will be given due consideration in the preparation of statements of cost for the purpose of this article.

5. The failure specifically to mention in this statement any item of cost is not intended to imply that it should be included or excluded.

Unfinished Business

1. Subcontracting

This is a knotty issue. As matters stand, the subcontractor has no contractual relations with the government and no direct claim against it. Yet the government does pass upon and authorize payment of claims presented by subcontractors to prime contractors.

For present purposes this system works quite well. The procurement agencies prefer to establish the chain of responsibility for the preparation and handling of claims downward from prime to sub, to sub-sub, and so forth, rather than attempt the gigantic task of dealing directly with hundreds of thousands of subs.

One big question requiring further definition is this: What is the government's responsibility to the sub in the case of an insolvent prime? Shall the government pay the sub—who entered the contract in good faith as his part in the war effort? This immediately raises another question: Shall public funds be used to bail out the private corporation which holds the prime contract?

The procurement agencies are inclined to take the attitude that they need a clear statement of national policy on this point before proceeding much further.

STATUS. Progress is being made with the problem, according to reports from OWM and the procurement agencies. There may be some announcement by the time this article appears. Manufacturers have been invited to recent meetings in Washington to discuss the formulation of a uniform clause.

2. Surplus Property

The Baruch article took one step forward toward solution of the problem of disposition of surplus property resulting from termination when it absolved contractors from responsibility for government-owned property and equipment 60 days after they submit inventory lists. This, it is generally agreed, should have the immediate effect of expediting the transmission of instructions from contracting officers to contractors on this point and helping the latter to get decisions which might otherwise be delayed.

Here is another instance in which present methods are working well enough. In today's market, the demand for materials and facilities is such that it usually isn't difficult for a contractor to propose, and a contracting officer to approve, some plan for disposition of surpluses. But any big volume of large-scale final cancellations would catch the government without a real policy.

STATUS. Policies relative to the disposition of machine tools, real estate, and so forth are in the "drafting" stage. Policies on the disposition of "personal" property have been formulated but not announced.

3. Interim Financing

Still a major issue, the question of getting money quickly into the hands of contractors to tide them over the termination period was brought but little closer to solution by the Baruch article. In general, the article does *permit* contracting officers to make advance payments and loans at their discretion, and in unspecified amounts. This is something of an advance to the extent that some disbursing officers and contracting officers have previously doubted their authority to make advance payments of any sort.

In the eyes of contractors, however, it is a far cry from the proposed *mandatory* advance payment of 75 percent of the claim which the government would be obliged to make on presentation of claim under the terms of certain bills which have been placed before Congress. A similar plan was also included in the ill-fated "WPB clause," another proposed uniform termination article which was considered for a time before the Baruch article went into effect. The armed services rejected the WPB clause just as they still reject in principle the whole idea of mandatory advance payment. It is only by legislation, therefore, that mandatory payment is likely to be adopted.

STATUS. A new policy has been formulated but not announced. It is designed to provide for prompter payment both of the prime contractor and the sub.

4. Appeals Procedure

Under present procedure, every effort is made to settle claims by negotiation alone. Failing this, the formula provided in the Baruch article is then employed. When that fails, recourse is had to the War Department Board of Contract Review. There remains as a final resort, of course, the contractor's appeal to the civil courts under the common law. Some World War claims were so appealed with success.

STATUS. Creation of an impartial Appeals Board, by legislation, is under contemplation as the next step following decision by the departmental board of review. Contractors who take their cases to the proposed new top board would be required to waive their rights to civil action.

5. Over-All Settlements

A frequently discussed question is this: Why can't the government dispatch a great many terminations by dealing with companies on their over-all, rather than their contract-by-contract, claims? Within and without the government there is a good deal of support for this policy. It isn't wanted as a mandatory, ironbound regulation, of course, but it is considered desirable, on an optional basis, by many contractors and some officials.

STATUS. The government can hardly be said to have come very close to a conclusion on this point as yet. Involved with it is the issue (Problem One) of whether or not the government should deal directly with subcontractors. The procurement agencies might welcome the discretionary authority to make over-all settlements with prime contractors and still shy away from any provision that would require them to settle with subs. Says one top-ranker: "Is it not possible that settlement will break down if the government is required to deal with 90,000 companies direct?"

Reprints of this article, "When Contracts End," are available at 15 cents per copy. Address: Editor, FACTORY, 330 West 42nd St., New York 18, N. Y.

Ready for Disabled Veterans

FRANK R. DEDRICK, Medical and Safety Director, The Bullard Company, Bridgeport, Conn.

WE HAVE HAD MANY YEARS of experience with physically handicapped workers. Since the emergency arose, it has helped us solve our manpower problem. Now that experience is going to stand us in good stead as we tackle the problem of finding jobs for veterans of this war.

Already we have reemployed 100 of our men who have been discharged from the Army. So far we have been successful in finding jobs for these men and are approaching this growing problem with increasing confidence.

We don't have all the answers. No one knows that better than we do. But, with 836 physically handicapped persons in our employ as of February 15, we have learned a good deal about matching jobs to handicaps.

To keep the record straight, we classify as physically handicapped all those working under waivers. We include not only men who have lost a hand, an arm, a leg, or, say, the sight of one eye, but also those with minor ailments that may conceivably get worse after they have been here for a time. I mean things like varicose veins and hernias, which can easily lead to something more serious. And, of course, that includes the heart cases, the strained backs, and so on.

Finding the Right Job

In every one of these 836 cases it has been simply a question of finding the job the handicapped person is best qualified to fill. Today our physically handicapped people are working not only on our principal products—machine tools—but also on the highly complicated war mechanisms for which we are prime contractors. They have proved to their own good satisfaction and ours that they can be successfully employed.

Even in a plant like ours, where required skills are unusually high, and where there is little light fabricating and assembly work, there is hardly a job in the shop that some one of them cannot handle.

In fact, from our experience, it has been proved that as a group they make as capable workers as those without handicaps. I think the explanation is simply that the physically handicapped fellow is out to prove to the other people in the shop that he is just as good a man as the next one and that his handicap is *no* handicap so far as turning out a day's work is concerned. Certainly he does not allow his handicap to keep him at home on days when the going is bad—as on the Friday just before this article was written, when Bridgeport had an 8-in. snowfall. These handicapped workers have materially aided the plant as a whole in maintaining its remarkably good absenteeism record.

It is easy to understand why for years we have been willing to let it be known that a physical handicap is no

BY MATCHING MEN AND JOBS, BULLARD

Listed below are a few of the jobs held by a few of Bullard's 836 physically handicapped workers. The company will obviously have no hesitation in placing disabled veterans on jobs like these

JOB	HANDICAP
Assembler	Epileptic seizures
Assembler	Limited vision, both eyes
Assembler	Abdominal weakness
Assembler	Deformed thumb
Department helper	Limited use (30 percent) right hand
Furnace man (forge shop)	Limited vision (20 percent) left eye
Furnace man	Deformed finger
Furnace man	Duodenal deformity
Hammer man	Varicose veins, feet and ankles
Hammer man (assistant)	Limited vision, both eyes
Inspector	High blood pressure
Inspector	Amputated ear; impaired hearing
Inspector	Total deafness, right ear
Jig storage man	Atrophied thigh and leg muscles
Jig storage man	Blind, one eye
Machine erector	Atrophied left leg
Machine erector	Fingers missing, both hands
Machine erector	Total loss of vision, left eye
Machine erector	Hernia, atrophied left leg
Machine operator	
Boring mill	Ruptured ear drum, chronic drainage
Boring mill	Two fingers missing, left hand
Cylindrical grinder	Deformed arm; limited motion
Cylindrical grinder	Loss of right eye
Drill press	Left leg shorter than right
Miller	Blind, one eye
Planer	Deformed foot; impaired vision
Planer	Deformed finger; hernia
Machine repair man	High blood pressure
Rigger	Hip condition
Timekeeper	Infantile paralysis
Tool grinder	Heart condition
Tool grinder	Crippled leg and foot
Tool grinder	Total blindness, left eye
Toolmaker	Body crippled; stiff thumb
Toolroom attendant	Loss of hearing (60 percent)

obstacle to employment at The Bullard Company.

We have been able to place these people in almost every department of the plant. We have taken men with poor vision in both eyes, or with a total loss of sight in one eye, and found machines for them to operate. We have found machines that could be run by men with deformed hands, men with one leg, men with the use of only one hand, men with an atrophied limb.

Numbered among them are 46 with crippled hands, 18 with crippled legs, 4 infantile paralysis victims, 37 with heart conditions, 21 who are hard of hearing, 34 with sight in one eye, 150 with extremely poor vision, not to mention dozens and dozens with serious organic ailments.

Some of these handicaps are, of course, minor in nature. Others require care and watchfulness. We have not hesitated to hire people, for example, who are subject to epileptic seizures and we have three in the plant at the present time. It goes without saying that they cannot be placed on machines. On the other hand, they do nicely at bench assembly work and on jobs of a similar nature where they neither endanger their own persons nor the safety of their fellow-workers. Incidentally, we find that it pays to keep them together because they seem to have a sort of sixth sense which enables them to discern in a companion the symptoms of an approaching seizure and thus be ready when the attack comes. By keeping them in one place, we have also found that nearby workers also quickly learn what to do when the emergency arises.

Harry Cramer, one of our supervisors, is a good example of a man with a physical handicap who has not let it stop him from making good at Bul-

FINDS PHYSICAL HANDICAPS NO BAR TO EMPLOYMENT

Frank Arrico, a spline grinder, may be blind in one eye, but he's a "keyman" to his supervisor

Timekeeper Ray Smith can check through a file as dexterously as a man with the full use of two hands

Alex Bero operates a 35-ton crane despite the loss of three fingers

Harry Cramer was badly crippled as a boy, but did not let the handicap stop him from becoming a machinist. Now he's a supervisor

lard's. Harry jumped from a barn roof when he was a small boy. He forgot to flex his knees and the femur bone of one leg was rammed so hard into its socket that the latter was split. He didn't walk for a year. In fact, the doctors who were trying to persuade his parents to permit an amputation said that he would never walk again. But he persisted, and not only managed to walk but also refused to look upon his disability as a handicap to earning his living and leading a normal and useful life.

He came with us back in 1916. Until just recently, when he was upgraded into a supervisory job, he was running a battery of three spline millers. As an operator he was one of the best in the plant. His production was always right up there with the best of them, and he has to his credit four valuable improvements on jigs and fixtures. His medical record over the years has been excellent, his attendance record practically perfect, and there is plenty of New England weather here in Bridgeport that could keep Harry home if he hadn't the will to work. Incidentally, after he leaves the plant, he is on call as a volunteer fireman in a nearby suburb.

We have many other interesting examples. X—— had infantile paralysis but has been running a drill press in spite of it for 15 years. Y—— came to us during the manpower crisis and said that he wanted to do two things —contribute something to the war effort and get enough money ahead to buy a new artificial leg. On Bullard assembly work he has been able to do both.

Z—— is another good example which also contains an interesting sidelight. His right leg was crushed in an off-the-job accident and had to be amputated above the knee. He was assigned as a learner in the grinding department. All went well for several months. His supervisor reported good progress. Then suddenly he told me that the job was getting too hard.

Remedying a Mistake

It turned out to be a simple matter to straighten out. He had been operating a machine whose carriage was moved with a right-hand control, and that meant bracing himself on his artificial right leg. The solution to his problem, which was merely to shift him to another grinder which can be handled from the left side, illustrates how simply a mistaken placement can be remedied when the facts are known.

The entire procedure with us is actually as simple as that. We get all the facts we can through our customary pre-employment physical examination and then decide what type of work a man is best able to do. After he has been on the job a couple of months, the medical department checks to make sure that everything is all right and then continues to make further periodic investigations.

Still more important, no worker can be transferred from one job to another unless his roster card passes through the medical department. For that matter, a complete medical history is kept of every worker in the plant, handicapped or not, and every worker who has been seriously ill or sustains any kind of injury must present a report from a doctor releasing him for work, and file a personal statement when he returns to his job. Here is a typical report filed by a man returning to work after an illness. It was selected at random from our files:

"On December 23 I came to work but was not feeling well, so I reported to first aid. The nurse took my temperature and I was sent home. I called Dr. —— who said I had the grippe. I stayed out of work until December 29. On that night I returned but did not feel too well and I worked hard to get the machines cleaned up. I do not remember any special time that my back started to bother me except that my back gradually started to ache about 3 a.m. The next day I could not come to work and called Dr. —— again. The doctor did not know exactly what caused my backache but strapped my back. I was released to come to work on January 3 if I took it easy. I continued to work and felt okay until January 21 when my back started to bother me again. My helper left a lot of work and I had to work quite hard. So my back gradually started to get sore again."

Careful Follow-Up

That statement is quoted here merely to illustrate the care with which the medical department investigates and follows up all illnesses and injuries. So far as it is humanly possible, we get all the facts, even in a simple case of muscular rheumatism like the one just cited. And whenever a physically handicapped person is involved, we are exactly twice as careful.

Out of it all, we believe, has come just the sort of experience a plant will need most when the disabled veterans begin to show up at its doors. Thus far we have rehired about 100 of our own people who have been discharged on account of flat feet, hernias, and so on. To date we have not hired a single serviceman who has lost an eye, an arm, or a leg on active duty—but we think we shall be ready for them when and if they come.

Begin Now to Conserve Paper

There *is* a shortage of paper. For the first quarter of 1944, the printing industry has been allocated 75 percent of the paper tonnage used during a comparable period in 1941. Unless a saving of 25 percent is made, end-use restrictions will be unavoidable.

Why does this affect you and your company?

Because your company, like every other industrial concern in America, is a buyer of commercial printing in one form or another. And the printing it buys is vital to the conduct of its business.

What can you and your company do about it?

First, cooperate with the local waste paper salvage campaign.

Second, ask this question every time you buy printing: Can we save 25 percent of the paper on this job? Then check:

1. ***Paper stock.*** **Is this the lightest weight we can use?**
2. ***Over-all size.*** **Is this the smallest practical size?**
3. ***Type.*** **Have we specified the smallest practical size?**
4. ***Design.*** **Is the general design and layout economical?**
5. ***Amount.*** **Have we checked carefully the quantity needed?**

In most cases the saving can be made with the greatest of ease.

Handling Equipment for Every Inch of Floor Area

J. R. MILLER, Works Manager, Link-Belt Ordnance Company, Chicago

"NOT A SQUARE INCH of floor space unserved by handling equipment" was the objective of the Link-Belt Ordnance Company when planning layout in its Chicago 37th Street plant. This objective was attained as the pictures herewith show. Actually, it was attained doubly for much of the floor area, which is served by mobile and hand trucks as well as overhead equipment. A controlling factor in the selection of handling equipment was low headroom. Installation of both handling and production equipment had to be made almost overnight in an existing building which had been used for the storage and service of some 500 automobiles.

Consider first the machine areas on the first floor. The battery of 78-in. vertical boring mills (Figure 1) is served by a series of 3-ton overhead bridge cranes. Both bridge travel and electric hoist are operated from the same pushbutton block. Enclosed conductor is used for safety.

Low-Headroom Cranes

How a 3-ton low-headroom crane is used to serve a horizontal boring machine is illustrated in Figure 2. The piece being handled is a large weldment. This crane has 3-speed drive on trolley and bridge. All controls are operated from one pushbutton station. In the background may be seen a jib crane which is used to augment the traveling crane.

An unusual handling device, of which there are several in the first-floor machining area, is shown in Figure 3. It is used to turn over the large weldment which must be machined on both sides. Low ceilings make turning the weldment over by overhead crane impossible. The operator imparts the turning motion by means of the large handwheel. Worm drive makes his part of the job easy.

The several examples of handling equipment next shown are in use in the smaller-parts machine areas on the second floor.

Overhead push-type cranes equipped with ½-ton electric hoists (Figure 4) serve the entire floor. Interdepartmental service is carried on by trucks, as the platform skids indicate. Attention of the reader is asked for the floor markings which indicate exact positions to be occupied by skids of materials and parts-in-process. This provision

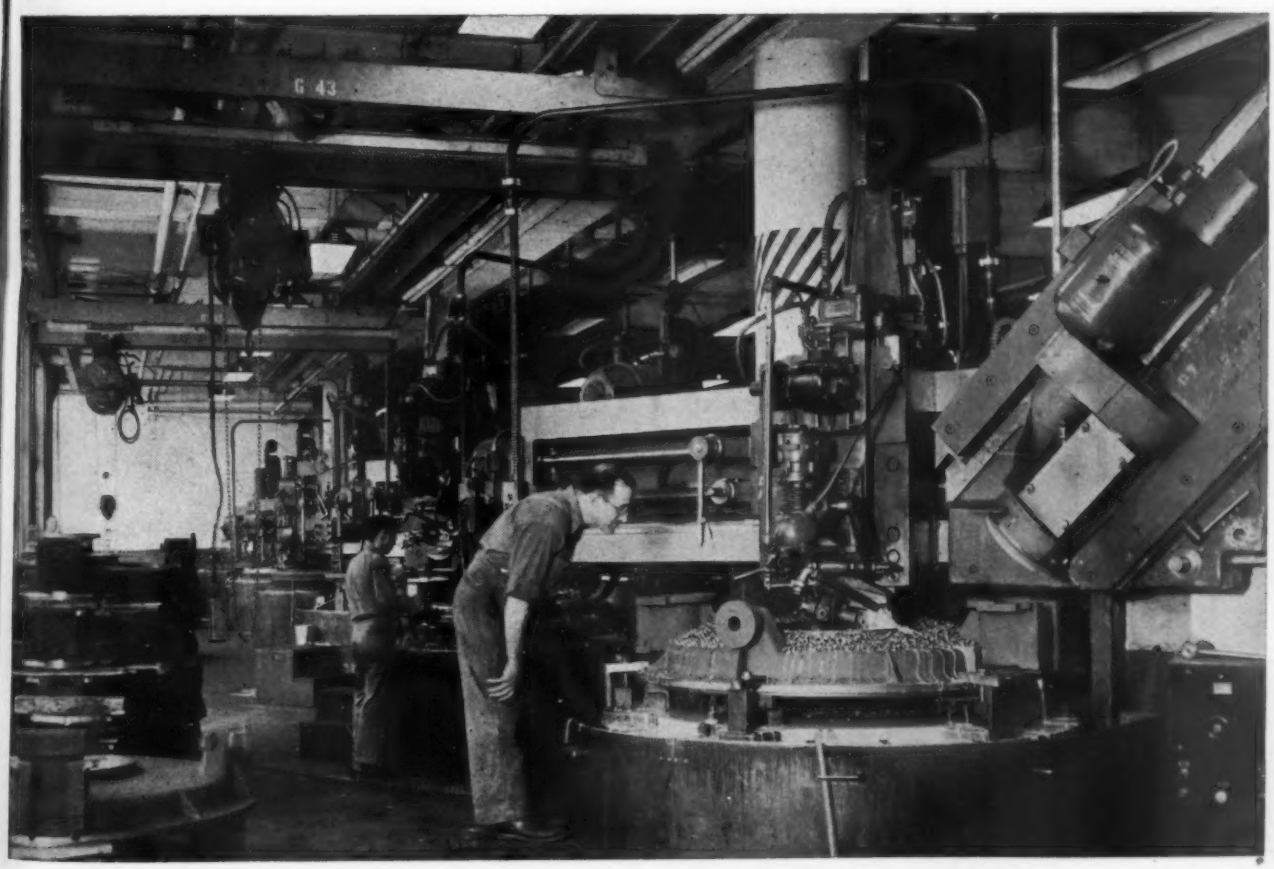


Figure 1. Overhead cranes serving boring mills, first-floor machine area

has much to do with getting the most out of both handling and production equipment.

Other Types of Cranes

Push-type cranes (Figure 5) are used to serve the thread-milling machines in the foreground and also the heavy machines in the background. The thread-miller operator is lifting a cast-iron screw blank for transfer to the rough-milling operation. After roughing, the screw will be placed on the wooden rack shown just to the right of the machine in the foreground. This rack has a slight incline toward the finishing machine so that the screws will roll from rough to finishing machines.

The extent to which handling equipment is made available, is indicated in Figure 6. In the foreground, a milling machine is being served by ¼-ton overhead equipment. In the rear, two 2-ton power-operated cranes are available. They are used to handle material in the side bays and to transfer subassemblies from second floor to first-floor main assembly area.

The final example from the second-floor machine area is the special two-decker truck (Figure 7) on which weldments are being moved. The angle irons which support the upper row of

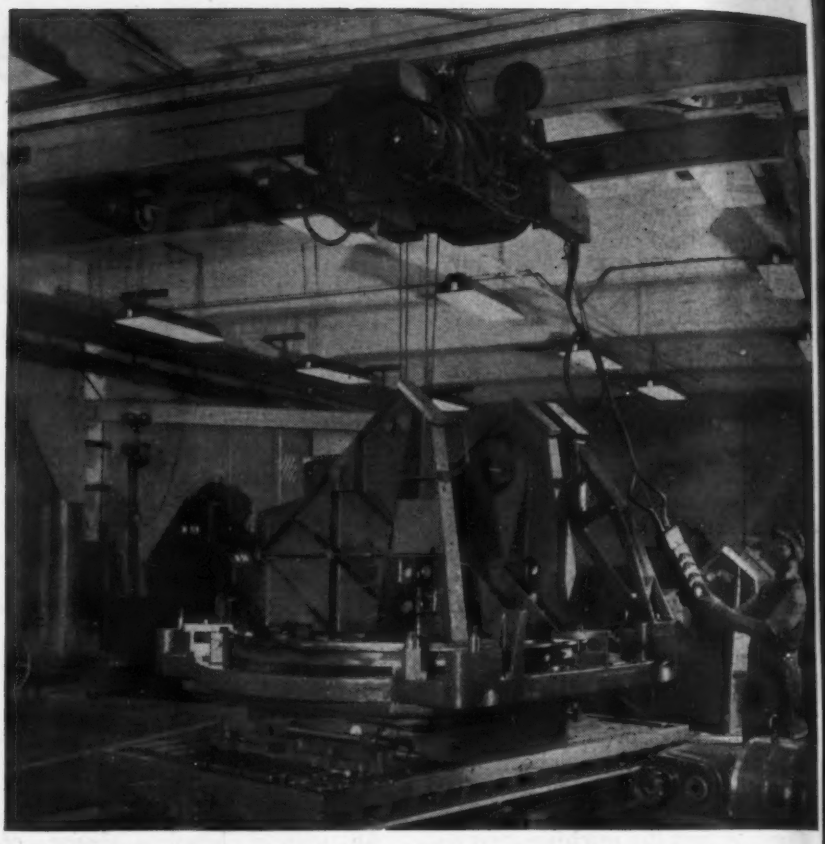


Figure 2. Low-headroom crane serving horizontal boring machine. In the background, jib crane used to augment the traveling crane

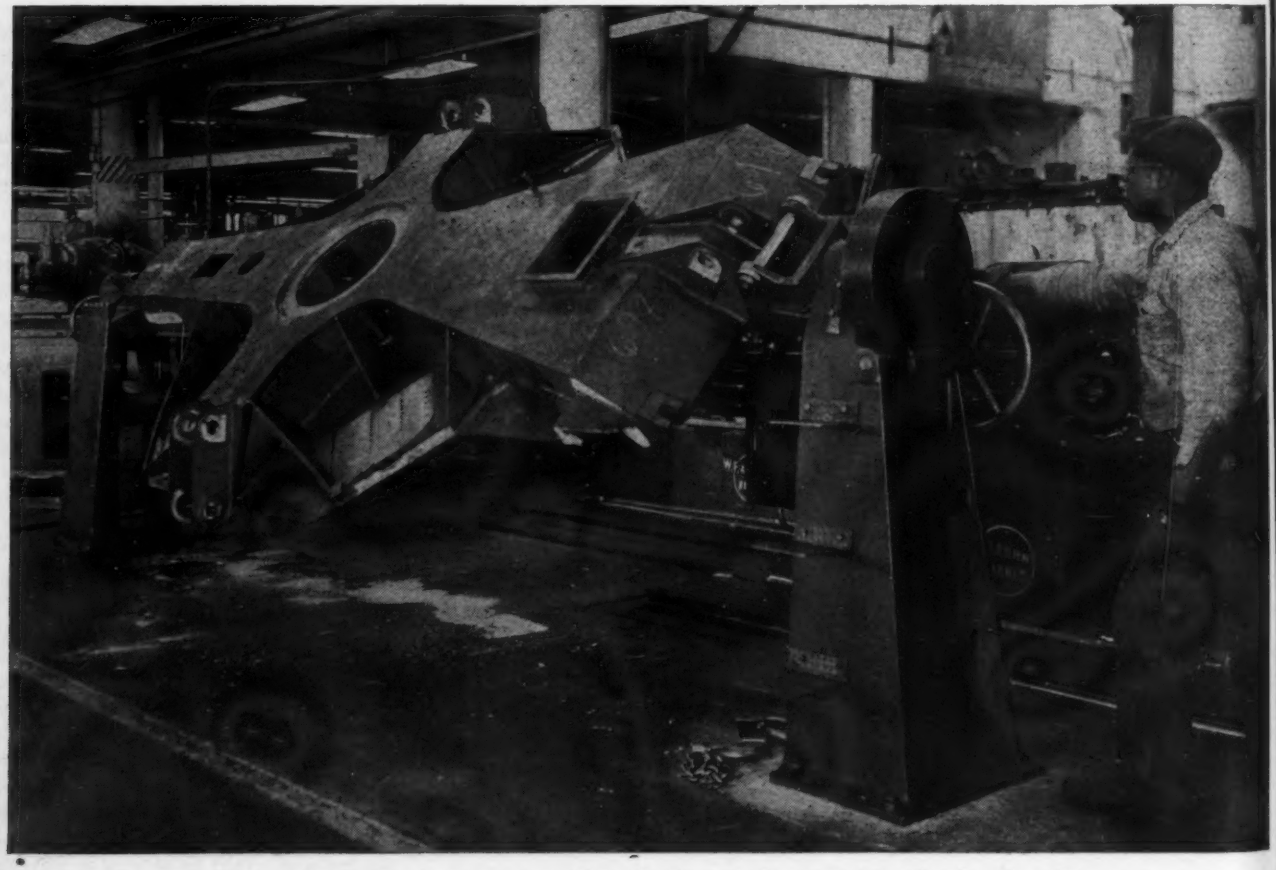


Figure 3. Roll-over fixture, a handling device made necessary by low headroom

Figure 4. Push-type cranes—with ½-ton electric hoists—serving machine areas on second floor

Figure 5. Push-type cranes serving thread millers and other machines on second floor

parts are lifted off to provide access by crane to the lower row.

Handling is a necessary operation in the welding area, too. Figure 8 shows how a portable platform elevator is used to handle not the work but the operator. The final result is the same —the positions of operator and work are so related that the one can do work on the other. In this instance the elevator is just as truly a piece of handling equipment as a crane would be that lowered the piece into a pit to bring the working surface to a level with the operator while he was standing on the floor. Incidentally, portable platform elevators are used in this plant in connection with a whole string of maintenance jobs, where equipment is big or work must be done at high levels.

Another operation in the welding area is illustrated by Figure 9. Operators are using a large vacuum cleaner for removing loose shot from a weldment after shotblasting. The handling equipment here consists of hand lift truck and platform skid.

Production of ordnance equipment in this plant has bettered delivery promises. A considerable and important part of the achievement can be attributed to handling methods and handling equipment.

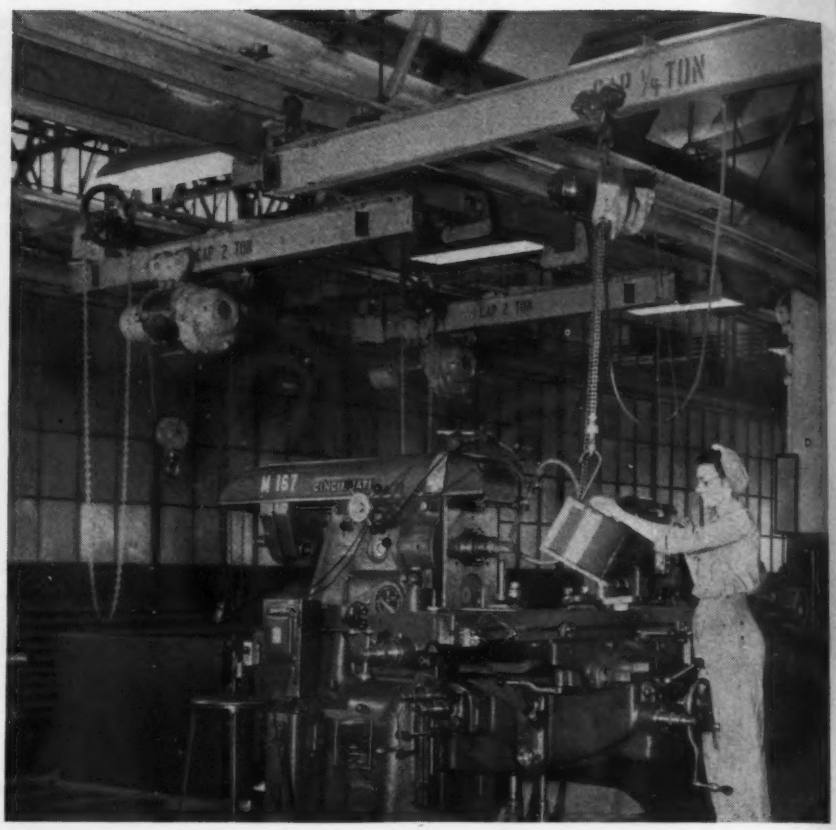


Figure 6. A low-capacity crane for machine service, and two larger cranes for side-bay service and between-floor transfer

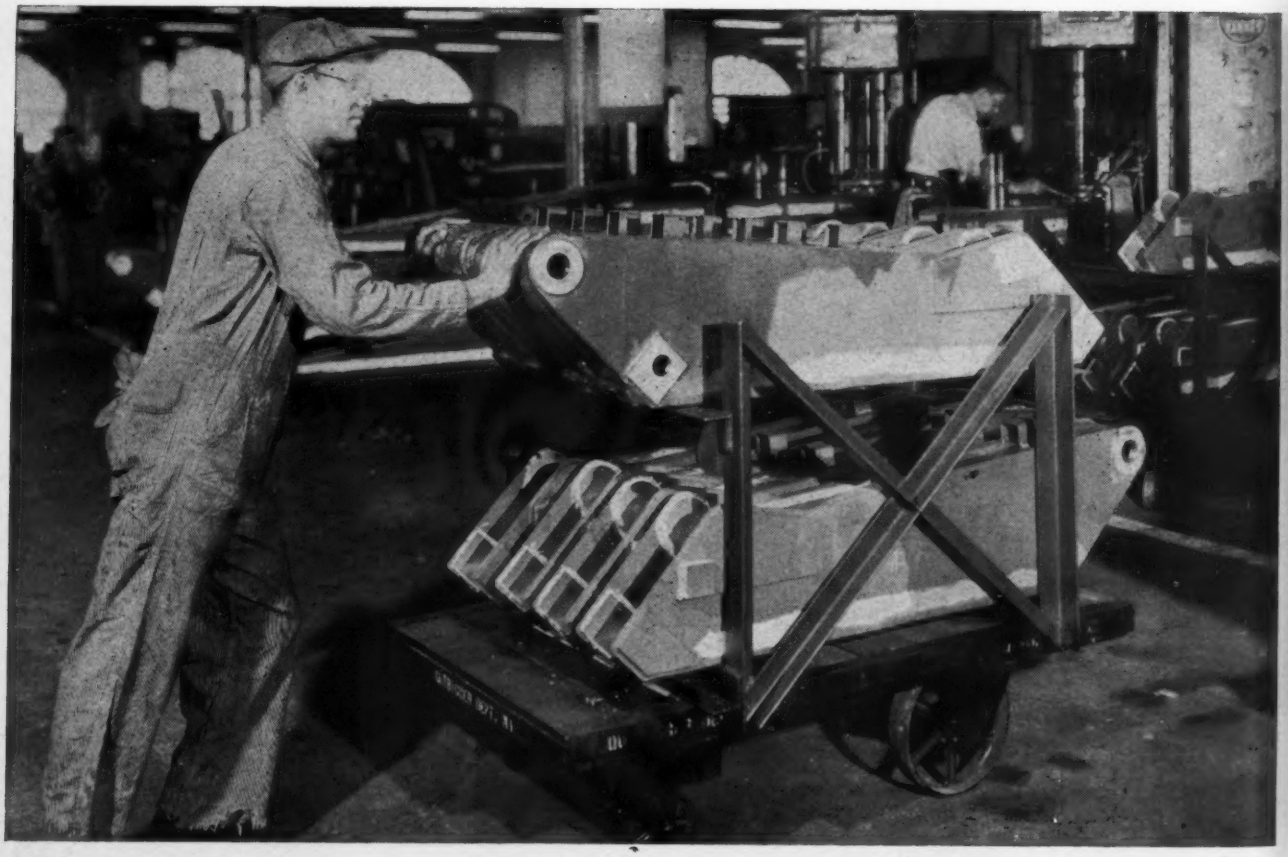


Figure 7. Double-deck floor truck was specially designed to facilitate short horizontal movements of heavy weldments. The angle irons that support the top row of parts are removable

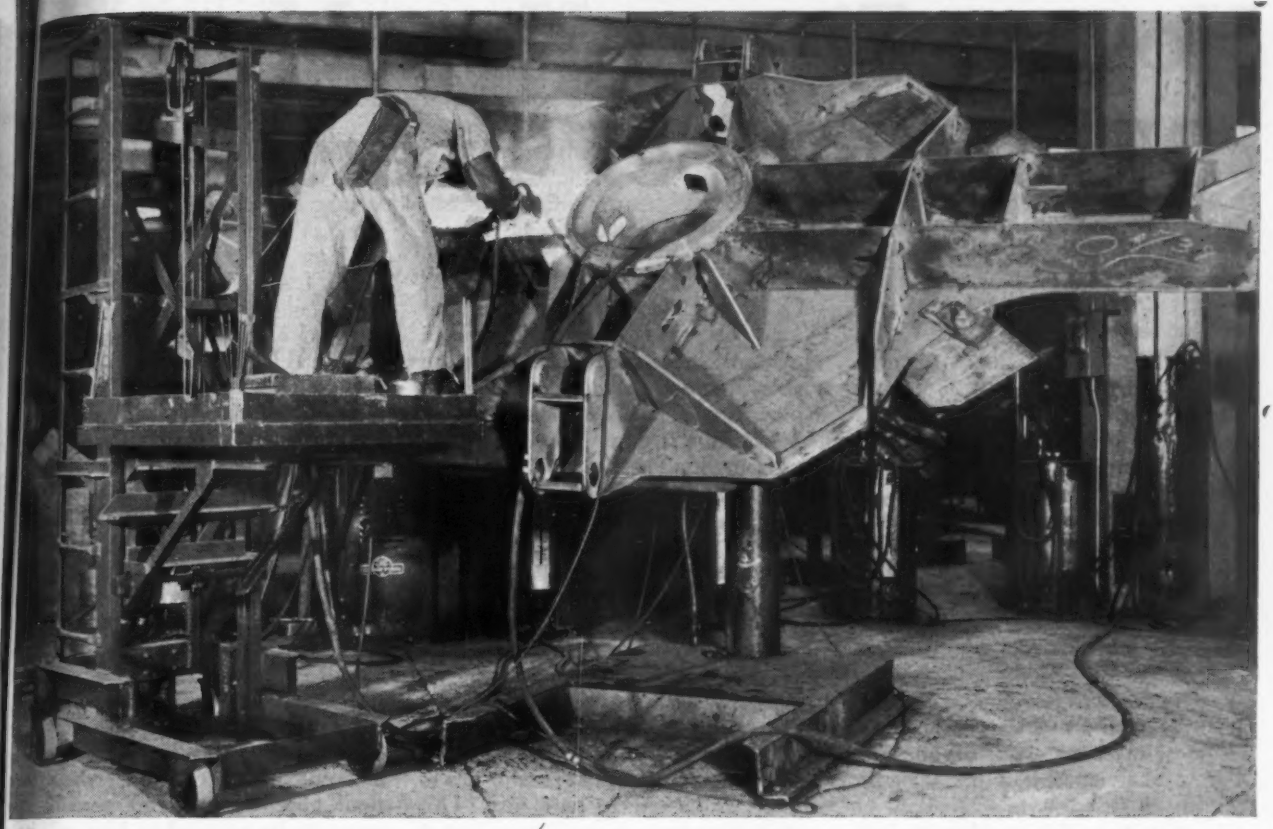


Figure 8. Portable platform elevator "handles" the operator rather than the work. It was simpler here to move the man up to working level than it would have been to bring the huge weldment down

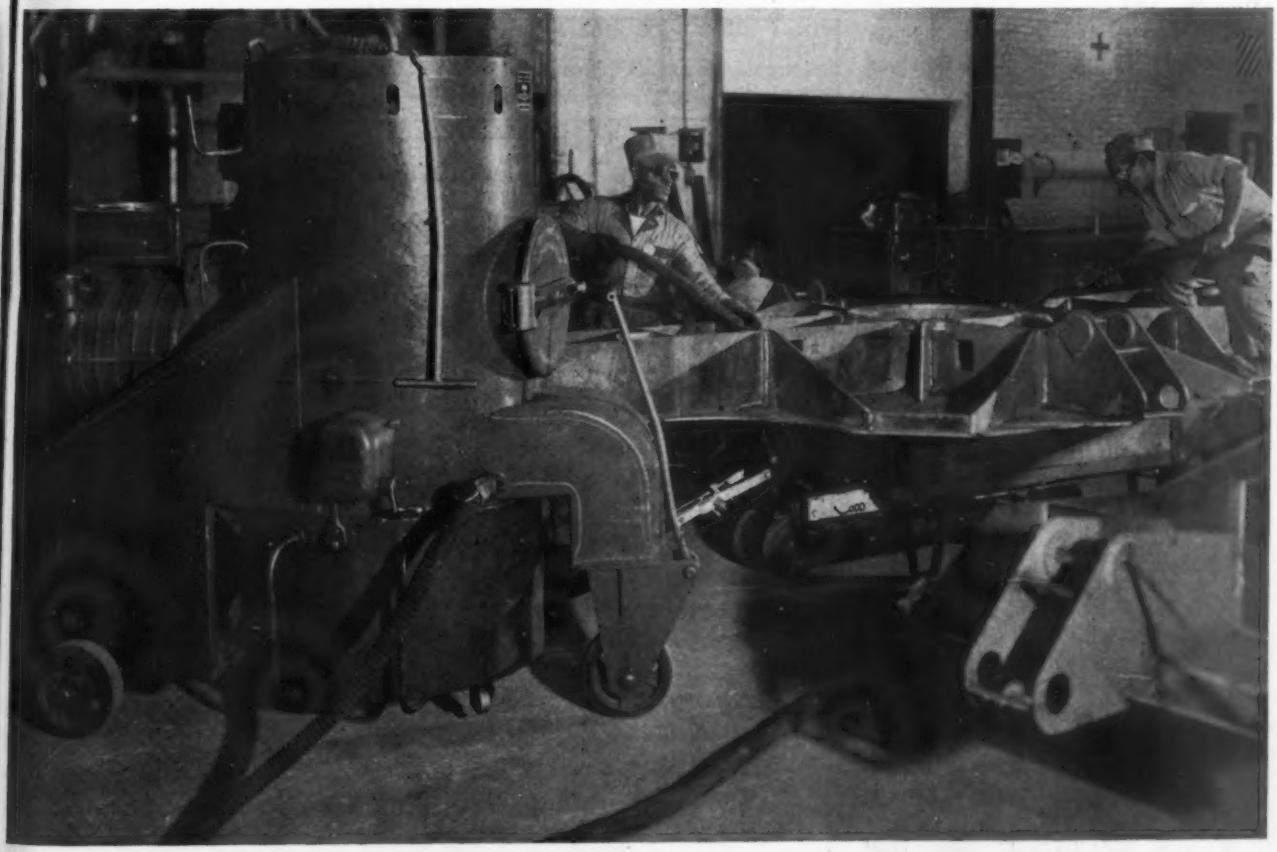


Figure 9. Hand lift truck takes on a big job. It is being used here to transport weldments from shot-blasting to vacuum cleaner, where loose shot are removed, then on to succeeding operations

How to Figure How Many Machines per Operator

FREDERICK FRANZ, Consulting Engineer, New Haven, Conn.

ON IDENTICAL PRODUCTION MACHINES tooled for identical production jobs, it is easy to find the number of machines that should be operated by one man (see, for example, "Charting Man and Machines," FACTORY, Sept., 1943). But in production work the problem is rarely so simple. Jobs usually differ and a variety of machines are found in the department. If one part requires two or three or more identical machines to produce it, it is unfortunately unusual that this group will give the exact production required. In short, operators handle a variety of jobs on a variety of machines, and the question of how many machines per operator continually arises.

A solution to this problem was recently required for a large group of milling machines. A search of current literature did not reveal any method other than the time-honored man-and-machine chart. As a result, the following method of close approximation was developed.

The Perfect Set-Up

Figure 1 shows the common man-machine chart for a simple case in which man time per cycle is 0.60 minutes and machine time is 1.20 minutes; total time, 1.80 minutes. Obviously three machines can be operated by one man if jobs and machines are alike, giving continuous employment to both man and machines. If the output is exactly what the production department wants, the set-up is perfect.

But Figures 2 and 3 tell a different story—the kind of story actually met in production work. Here we see the "endless man-machine chart" continued for a calculating period of 14.74 minutes in Figure 2, and applied for a trial to four machines. The result over this period indicates that the man is idle 32 percent of his time, while idle machine time is 7.6 percent. By adding a fifth machine to the group (Figure 3), the man's idle time is reduced to 7.2 percent and machine idle time is still only 6.4 percent.

A third man-machine chart (not illustrated) shows that adding a sixth machine increases the machine idle time to 19 percent, but leaves the man's idle time low at 8.1 percent. Obviously one operator should be assigned to the five machines, as a close approximation to the best utilization of man and machines.

Although this conclusion can easily be drawn from the chart, the preparation of these charts is a laborious and time-consuming procedure, especially if job changes are frequent. Moreover, the order of attention to be given to each machine by the operator will not necessarily be as shown in Figures 2 and 3, because frequent instances will be met when two or more machines finish together and the operator has to choose which one to tend first. This option may be seen in Figure 3 at *A* and *B*. In both instances the operator has the choice of tending either No. 11 or No. 13. Although this indicates that no exact result may be expected, it is not likely that large deviations will be introduced by it.

Now it is possible to determine the number of machines per operator by employing the conception of the percentage of any one cycle that the operator is engaged in that cycle. For example, if man time is 0.66 minutes and machine time is 2.00 minutes (total time, 2.66 minutes), the operator is employed 0.66/2.66 or 24.8 percent of this cycle in tending this machine. Such man-time percentages may be calculated for each one of a group of adjacent machines, and, when their total approximates 100 percent, the group to be assigned to him will have been determined.

Let us check Figures 2 and 3 by this

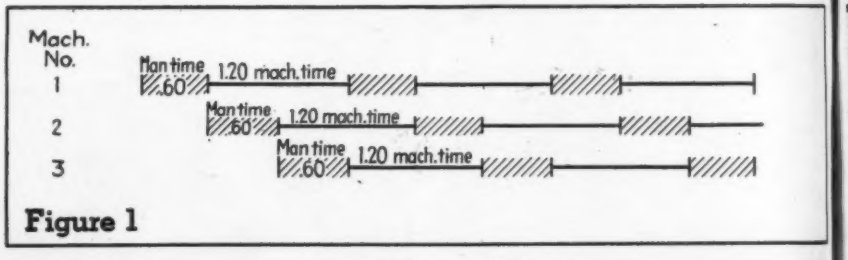


Figure 1

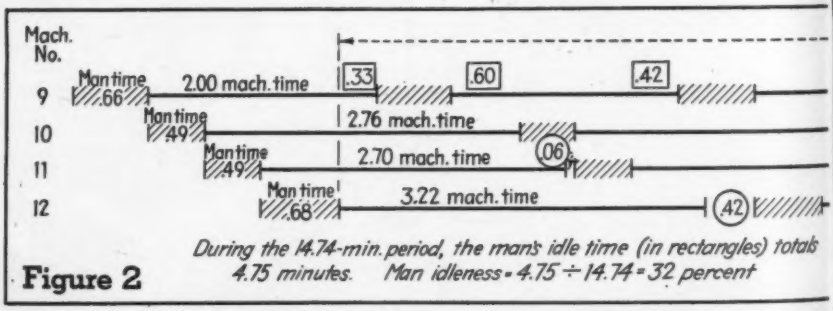


Figure 2 *During the 14.74-min. period, the man's idle time (in rectangles) totals 4.75 minutes. Man idleness = 4.75 ÷ 14.74 = 32 percent*

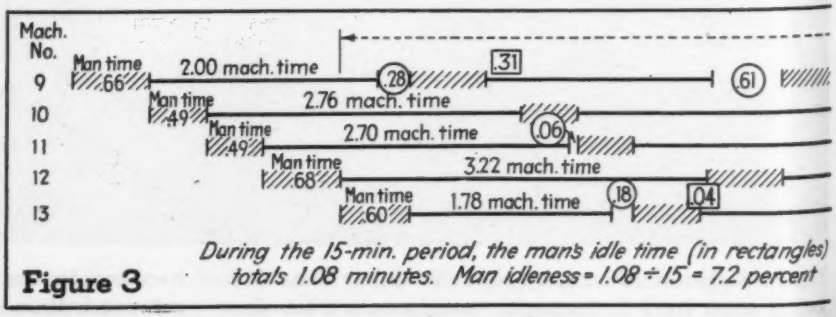


Figure 3 *During the 15-min. period, the man's idle time (in rectangles) totals 1.08 minutes. Man idleness = 1.08 ÷ 15 = 7.2 percent*

method. Table I shows that the four machines employ only 72.6 percent of the man's available time, whereas the five machines employ 97.8 percent of his available time, assuming there are no interruptions.

It is not always possible, by simply adding successive machines, to arrive at a percentage as close to 100 percent as this last one is. Moreover, as previously pointed out, the actual machine idleness is not a mathematical exactitude, being somewhat dependent upon the frequent choice of the operator during the course of the day. Still further, some allowance must be made as an incentive to achieve a standard performance or a premium wage. To take care of these three variables, a chart (Figure 4) was prepared. This chart may be used when it is desired to establish a quota for each machine for purposes of measuring the worker's performance or setting wage payments for attaining production standards.

Referring to Figure 4, the reader will observe that, for an allotment of machines totaling exactly 100 percent man-time employment, only 83 percent of the calculated production is set as the quota for each machine. For example, if the total calculated cycle time for a certain machine is 2.66 minutes (which equals 225 cycles in a 10-hour day) only 83 percent of its production, or 187 cycles of production, is set as the quota. The 17 percent reduction is due partly to unavoidable machine idleness (6.4 percent in the five-machine layout described above). The remainder, 10.6 percent, is a purely arbitrary incentive, and is the amount offered in this case to attain the quota.

Other firms may want to increase or decrease this figure, so each production man must arrive at his own conclusions regarding this allowance for incentive and, consequently, regarding the exact location of the quota point on the curve at 100 percent of the man-time employment.

The other points on the curve in Figure 4 are plotted for those instances in which a whole number of machines cannot possibly be arranged to equal exactly 100 percent employment of the operator's time.

In Table II, for example, machines 64, 65, and 66 total 81.0 percent of the operator's time, meaning that more man time than is required will be available to tend each machine. If we add machine 67, the four machines will require 114.1 percent of his time, meaning that some machines will stop and occasionally wait for operator attention. All this affects the production and the quota. For example, at 81 percent (three machines) the quota from Figure 4 is 90 percent; at 114.1 percent (four machines) it would be 73 percent of the full-time calculated production of each machine. In wartime we should probably choose three machines for maximum plant production; in peacetime we should probably choose four machines for lowest labor cost per piece.

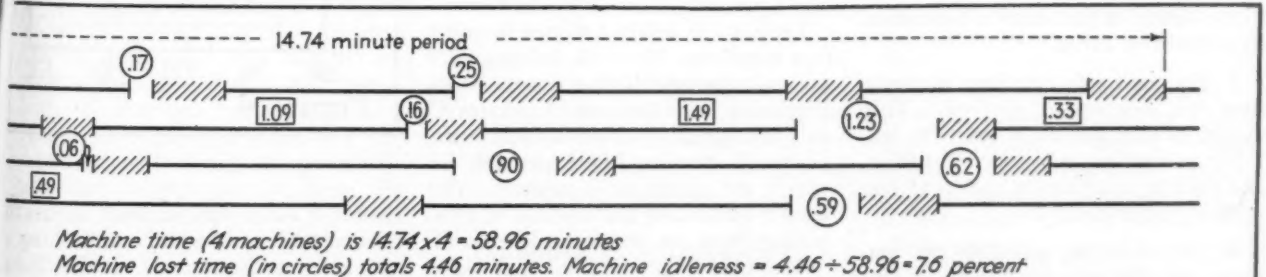
When this method of establishing the number of machines and the quotas is installed, it will be found that even the stupidest operator will promptly discover that the quota set on the same job in the same machine will not be constant, but will vary with

Table I. Ratio of Man Time to Total Time

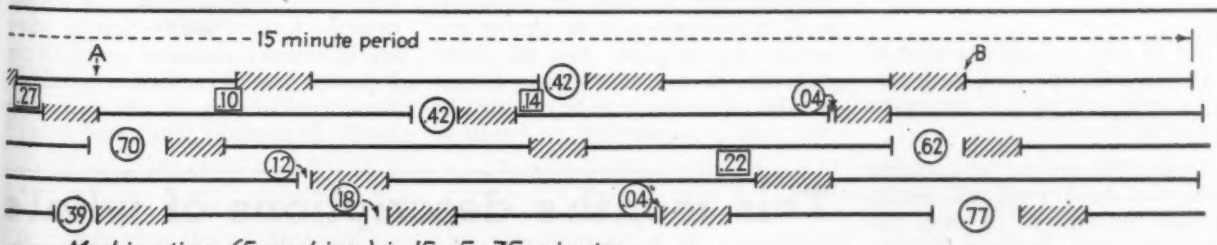
Machine No.	Man Time	Total Time		Percent of Total Time
9	0.66	2.66		24.8
10	.49	3.25		15.1
11	.49	3.19		15.3
12	.68	3.90		17.4
13	.60	2.38		25.2
			Total, 5 machines	97.8

Table II. Ratio of Man Employment Time to Total Time

Machine No.	Man Time	Machine Time	Total Time	Employment Time (percent)	Cum. Employment Time (percent)
64	0.60	1.55	2.15	38.7	38.7
65	.66	2.39	3.05	27.6	66.3
66	.49	3.32	3.81	14.7	81.0
67	.38	1.15	1.53	33.1	114.1



Machine time (4 machines) is 14.74 x 4 = 58.96 minutes
Machine lost time (in circles) totals 4.46 minutes. Machine idleness = 4.46 ÷ 58.96 = 7.6 percent



Machine time (5 machines) is 15 x 5 = 75 minutes
Machine lost time (in circles) totals 4.83 minutes. Machine idleness = 4.83 ÷ 75 = 6.4 percent

Table III. Machines per Man—and Quotas per Machine

A Machine No.	B Man Time (min.)	C Machine Time (min.)	D Total Time (min.)	E Man Employment Time (percent)	F Cum. Man Employment Time (percent)	G Quota (percent)	H Hourly Quota (percent) (60/D × G)
21	0.52	2.15	2.67	19.5	19.5		60/2.67 × 0.83 = 18.7
22	.43	4.35	4.78	9.0	28.5	Operator *A*	60/4.78 × .83 = 10.4
23	.61	3.22	3.83	15.9	44.4	#21 to 26	60/3.83 × .83 = 13.0
24	.44	1.23	1.67	26.3	70.7	Quota (from	60/1.67 × .83 = 29.9
25	.66	2.88	3.54	18.6	89.3	Figure 4)	60/3.54 × .83 = 14.1
26	.36	3.17	3.53	10.2	99.5	83%	60/3.53 × .83 = 14.1
27	.56	3.32	3.88	14.4	14.4	Operator *B*	60/3.88 × .84 = 13.0
28	.51	2.15	2.66	19.2	33.6	#27 to 30	60/2.66 × .84 = 18.9
29	.39	1.51	1.90	20.5	54.1	Quota 84%	60/1.90 × .84 = 26.5
30	.53	.68	1.21	43.8	97.9		60/1.21 × .84 = 41.7
31	.44	1.23	1.67	26.3	26.3	Operator *C*	60/1.67 × .79 = 28.4
32	.20	1.23	1.42	14.1	40.4	#31 to 35	60/1.42 × .79 = 33.4
33	.19	1.06	1.25	15.2	55.6	Quota 79%	60/1.25 × .79 = 37.9
34	.25	.84	1.09	22.9	78.5		60/1.09 × .79 = 43.5
35	.40	1.03	1.43	28.0	106.5		60/1.43 × .79 = 33.2

the jobs he handles and with the number of machines in his group.

Although this is theoretically, mathematically, and practically correct, it seems contrary to one's cursory judgment. The quota set on any job in a specific machine will only remain constant as long as the total percent of the man's time employed in tending his machines remains constant. If, under multiple-machine operation by one man, it is arbitrarily decided to maintain a quota constant on any one job, regardless of the changes in other jobs handled by the man, it can be done only with injustice either to the man or the employer.

As a result of this study it is possible to write these rules:

1. For each job, calculate the man time by any sound method. This should include walking to machine, unloading, cleaning off chips, reloading, and starting machine, as well as all the necessary allowances.

2. For each job, calculate the machine time by any sound method; also the total time (man time plus machine time).

3. For all jobs, calculate percent of man time to total time. Set these percentages down in a table of successive and adjacent machines.

4. *To find the number of machines that one man should tend,* add, successively, the percentages of each machine. As soon as the sum approximates 100 percent, those machines comprising this total will be the particular machines and the number of machines that should be tended by one operator. *To find the quota for each machine,* multiply the calculated quota for full-time production by the factor from Figure 4.

An example will illustrate the application. Table III lists part of a group of machines in a plant. The nearest approach to 100 percent cumulative employment of the man's time is reached at machine 26, when it is 99.5 percent. Therefore, these six machines should be assigned to operator A. The percentage is so close to 100 percent that the quota is set (from Figure 4) at 83 percent.

Operator *B* will be assigned the next four machines, 27 to 30, totaling 97.9 percent, for which the quota (from Figure 4) is 84 percent. Operator *C* will be assigned the next five machines, 31 to 35, totaling 106.5 percent, for which the quota is 79 percent. The hourly quotas and the method of computing them are shown in column *H*.

It should be pointed out that this is not a system of wage payment or an incentive system, although it can be used in connection with almost any variety of wage plan. Also, the determination of the most nearly correct number of machines to be operated by one man is one problem, and may be handled alone and without regard to the related problem of establishing a quota for each machine. It should be emphasized that greater individual analysis of each job is required when the machine time is short—that is, when less than three machines per man are indicated by this method. In such instances each step in the procedure should be carefully scrutinized.

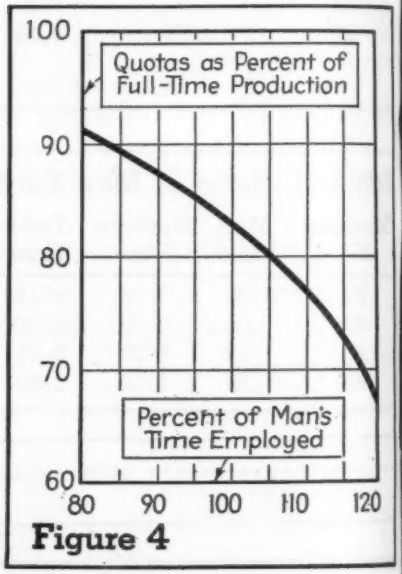


Figure 4

This month's descriptions of what's new in equipment begin on page 170

Get Those Foremen Ready for Their Post-War Jobs

WHITING WILLIAMS, Consulting Editor, *Factory*

When faced with the need for extraordinary production for war, industry found that it simply had to make better executives of its foremen. Having discovered that, it quickly found effective ways. Because of the necessity for efficient production, it is going to be just as essential to have the right foremen executives for peacetime purposes. Now is the time for plant management to decide upon company post-war policies and practices for foremen

WILL YOUR POST-WAR FOREMAN *be* your Company? I asked this question of an experienced factory manager, and this was his answer:

"Before starting to tell each of our foremen just how he should handle his post-war workers in order to help us meet our post-war competition, I decided to find out just how we'd been handling *him*. For now that we have, over the years, assigned so many of his former responsibilities to other departments, we can't blame him for falling down on his job of directing his people if we fall down on ours of serving him. What I discovered is plenty!"

His words made me want to air-mail my apology to a certain boss against whom I've nursed a grudge for years. On the cold rolls of a certain steel plant my buddy and I had begged him, day after day, to give us the iron guards we needed for piling our steel sheets straight enough to permit the craneman to grab and lift them. Because he failed to heed our pleadings, we lost precious tonnage earnings while, every hour or so, we concocted a fragile substitute out of stray pieces of wood—and under our breath cursed him for his negligence.

But now it occurred to me that perhaps he wasn't to blame. Maybe he had passed our appeal along to the storekeeper, only to be told, "We're fresh outa them guards and will be till next month!" Maybe, also, the storekeeper wasn't to blame. Maybe he'd been hounding the maintenance boss for weeks—with that officer, in turn, at his wit's end because the super, the comptroller, or other chief had decided to teach somebody a lesson about staying within his budget.

Plainly enough, the stiffer-than-ever demands of post-victory conditions will require better-than-ever training of the foreman. But, also plainly enough, this training will bring disappointment unless the manager can put a lot more meaning into his ancient, trite assurance that "in the eyes of your workers you foremen are the Company."

One of the big defects of the foreman training course has long been that it is so simple and so easy for the manager to arrange for it. After he has signed the check for the series, he can forget about it—and then, perhaps a few weeks later, reduce its value to zero by handing out some fat plum of promotion to the "student" who, although a "good producer," is nevertheless famous for disregarding every one of the principles the class has discussed at session after session.

Foreman Is the Goat

But even if the Brass Hats thus too often fail to support the foreman as "our keyman," his workers seldom fail to make him the goat for whatever sorenesses they may have suffered at the hands of any and every other department in the plant.

"When I *do* get a job here," more than a few of my fellow job seekers used to say as we waited hour after hour for attention in the employment office, "my boss is sure goin' to have one hell of a time gettin' much work out o' me till I get even with the blank blanked company for this."

Similarly nursed for taking out later on the poor foreman are the grudges caused by plant guards who so often fail to see in the forlorn and hopeless job seeker at the gate today the self-respecting, hopeful job holder in the plant tomorrow. Even more numerous and continuous are the hurts caused by the paymaster's clerks who so frequently pass out the pay checks in a manner that seems to say: "Here's your precious money, but I know darn well you didn't earn it."

To such as these, of course, should be added the total of blame heaped upon the foreman for the various fall-downs made visible in him but originating in places too remote to be discernible to worker eyes.

"To my gang," so one foreman put it, "I'm the company. Sure. But to the Company? That's something else again!"

All this is far from saying that the foreman himself is blameless. Generally he appears to take proper pride in his heavy responsibilities and his comparatively high rung on the plant's job ladder. But altogether too often he fails to imagine that his workers *wish* to take comparable pride in the performance of their own lowly duties. Too often he appears to assume that they will respond to nothing but their fear of his quit slip or, more latterly, to some ingenious form of "rawhiding." For years, of course, the biggest obstacle to any successful suggestion plan has been the employee's fear that his boss would take his proposal as personal criticism or personal competition —or else hog the credit for it.

For all this the cause is often less to be sought in the foreman than in his various superiors. All too frequently he has felt compelled to over-manifest his authority and over-guard his status because too little pains had been taken by the higher-ups to quiet his own fears about his own importance, credit, and security.

"Today," a Cleveland organizer recently testified "we are bothered enough by our members' fears of post-war joblessness. But, worse than that,

What Every Manager Can Do to Prepare Foremen for Post-War

1. Make a plant-wide study of just how every supervisor is expected to spend his working time and just how he actually spends it. One such survey turned up a foreman who was responsible, every eight hours, for handling different functions totaling 246! Another revealed that most of his titled foremen no longer had any contact whatever with their workers. Little by little this part of the job had been handed over to the job-setters and gang leaders; they answered all questions, granted all leaves, delivered all specific instructions. But, since they had no place on the chart, not one of them had ever sat in a training course.

2. List all the services—such as hiring, firing, lighting, ventilation, janitoring, tool supply, and maintenance—on which the foreman (also his gang bosses) must depend. Make a careful study of how fully and how helpfully these are actually put at his disposal.

3. Lessen the foreman's fear of his superior's whims by arranging for some third party (e.g., the personnel director) to hear his complaints or his appeal. His superior may represent his biggest trial—with vastly less freedom to bypass him than is now enjoyed by the lowliest rank-and-filer.

4. In the light of the above, weigh carefully the net differentials of pay, perquisites, security, and opportunity enjoyed by his foremen over their workers.

5. Tell every supervisor at least as much about company problems, policies, and projects as he does his committee men—and sooner! Better still, get the supervisor's ideas about these matters.

6. Support his training course's emphasis of the human factor by regularly asking his supervisors—and listening hard and intelligently while they tell him—about the temperaments, interests, and problems of their individual workers. Disappointment with the results of this inquiry is frequently reported. But pressure on the single item of maximum output has been exerted too long to favor immediate returns from this new and sudden additional assignment.

7. Demonstrate willingness to consider the supervisor as a two-way channel of worker communication—up from them as well as down to them. In too many organizations this up-route has been monopolized by the steward, and too many personnel departments operate as a substitute for the supervisor rather than his aide.

8. Make his own serious search for a yardstick of supervisory excellence by experimenting with voluntary tests and involuntary but "well-sold" ratings. For real results, follow these with personal and confidential conferences calculated to help the man improve his showing and himself.

9. Stress, re-stress, and stress again the fact that, from the worker's viewpoint, an ounce of honesty, squareness, and fairness outweighs a pound of any foreman's technical equipment or intellectual "know-how."

10. Use regular but informal "social luncheons" or similar expedients for protecting himself and his associates against the evils now widely inflicted upon the bosses of foremen, and hence upon the foremen, by the prevailing disease of "executive fatigue." Its symptoms are over-hasty judgments and unwillingness to hear both sides. Caused as it is by over-sudden plant expansion, blitzlike cutbacks and cancellations, arbitrary renegotiations, and belligerent labor leaders, this war disease appears unlikely to be immediately cured by victory.

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a lot of foremen keep secretly nagging us to handle their beefs or at least to furnish them some such right of appeal against arbitrary demotion or discharge as all us workers enjoy."

Unless manufacturing costs are lowered by super-efficient management, all the seniority in the world will hardly suffice to save wage earners from some spottiness of post-victory unemployment. But it does assure them that whatever short-term layoffs prove inevitable will be based on something more predictable than the boss's whim. Not so with the foreman. To be sure, he is more likely to stay on the payroll than they. But he can hardly be blamed for worrying today about the possibility of demotion—and, worse, about the chance that such demotion may be based on some measurement which, so far as he can see, is altogether arbitrary.

Most executives have learned that every foreman views his return to the ranks as a calamity. More than a few managers, indeed, wonder whether such downgrading is not wisely avoided by complete discharge. In actuality, both steps spell such serious personal tragedy that few managements are willing to apply either of them.

It would be of vast assistance, both to industry's post-war efficiency and also to the foreman's present-moment state of mind, if somehow management could discover more definite and more demonstrable methods of measuring the goodness and the badness of its supervisors. Millions of workers and thousands of bosses, little and big, stand to enjoy greater effectiveness and greater security as the result of the intensive search for these measurements that is now under way in a Cleveland college and in a number of other places. But as long as "leadership" is so elusive and so many-sided a quality, with the proper balance between its technological and its psychological requirements so hard to determine, the results are hardly likely to be of much early help.

At any rate, the wise Boss of Bosses has a good chance at the jack pot of lower post-war costs and better post-war competitive position if he takes a hint from the factory manager first quoted and ponders now both his training courses and also such additional steps as those shown herewith.

All this, of course, boils down to management's preparing for post-war success by making sure that, besides training foremen, *it does unto its foremen as it would have them do unto their men.* With that, it's dollars to doughnuts that more post-victory foremen will hear the assurance, "To your workers, you are the Company," without muttering under their breath—"Baloney!"

How Color Helps Solve Plant Layout Problems

F. H. DEVOR, Factory Manager, Highland Park (Mich.) Plant, Chrysler Corporation

STRAIGHT-LINE SEQUENTIAL LAYOUT of equipment with conveyorized handling is always desirable, but in some types of manufacturing this ideal would result in an excess machine investment, unless some modification or adaptation is made. In addition, space limitations may act as a modifying influence.

For example, four different axle housings are machined in the Chrysler Corporation's axle housing department; eight machines perform common operations on three of the housings; and nineteen machines operate on two of them alternately without set-up change. These machines, together with twenty-seven that operate on only one kind of housing, are all arranged in sequential flow. Moreover, all four types are run through a common cleaning and inspection operation. This arrangement gives compactness in layout, minimum parts handling, and a maximum use of machine equipment.

The layout on the reverse side of these pull-out pages indicates, by appropriate colors, which housings go over which machines. For convenience, we shall refer here to the *red* housings, the *yellow* housings, and so on. The output figures used are for illustrative purposes only.

Balanced Production a Vital Need

Let us assume that 40 red, 20 blue, and 20 yellow housings are required per hour. Twenty black housings are required per hour, but then only two operations – wash and inspect – are common with the first three housings. The major problem, therefore, revolves around proper balance of the first three types with the available equipment.

The color scheme was evolved to facilitate use of the layout drawing by all concerned – management, process engineering, time study, and plant engineering.

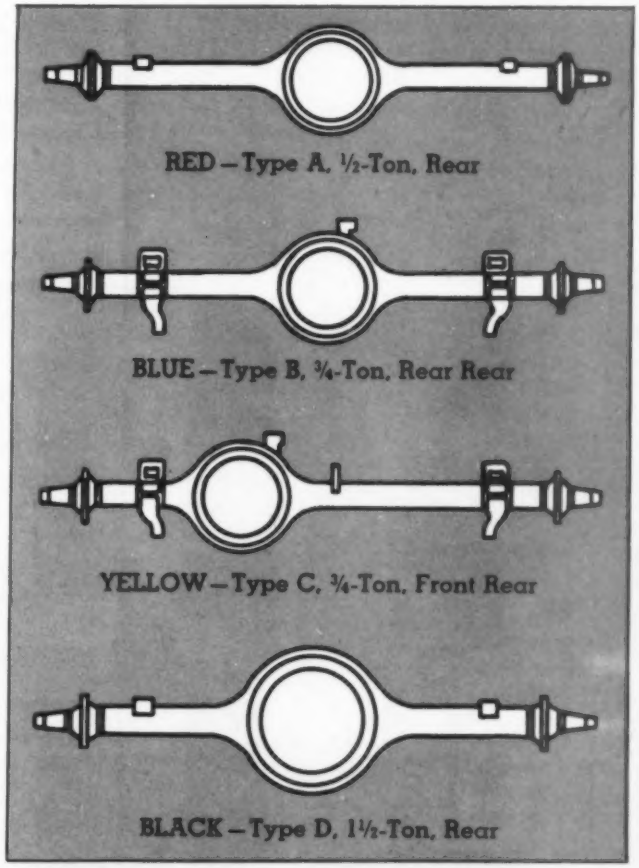
The first operation on the red, blue, and yellow housings is No. 10, mill gear clearance; and the output per hour is 40, 20, and 20, respectively. The machine, therefore, is colored with these three colors; the templet space is divided in the same 40-20-20 ratio.

The same thing is true for operations 20, 30, and 40. But notice the sequence of these operations. From No. 10 the housing is delivered by electric hoist operating on an overhead monorail, indicated by the dotted rectangle, to an inclined rack which slides the housing to operation 20; then, also by hoist, to operations 30 and 40. All four of these machines operate continuously on the three housings in the quantity called for by the schedules.

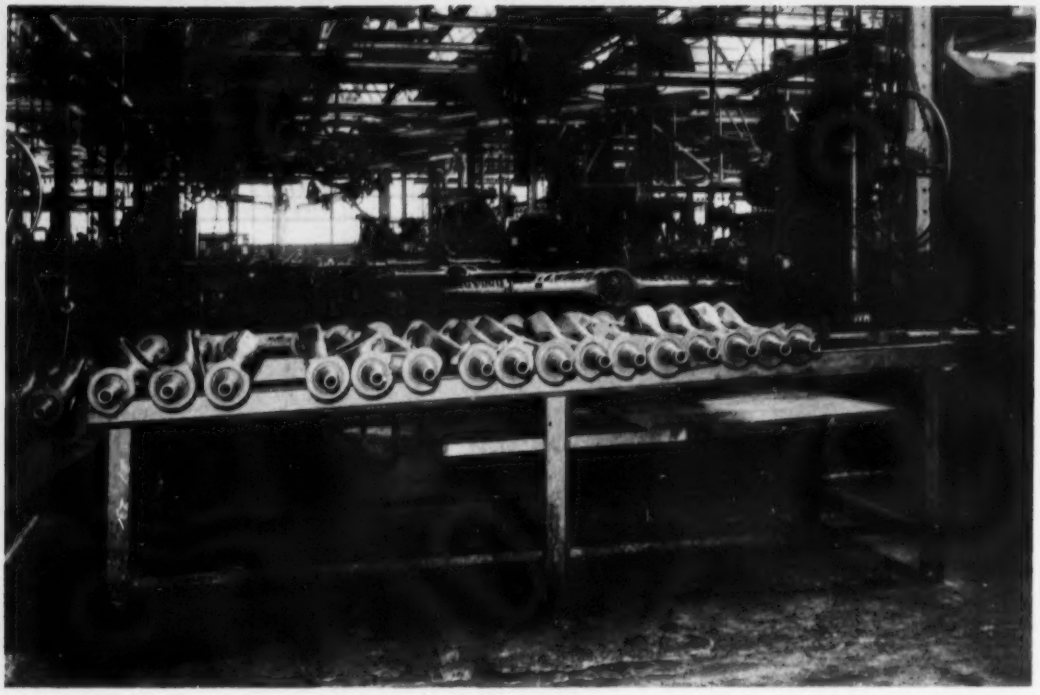
After operation 40, face ends, is completed, the red housing is delivered by hoist to an inclined rack leading to operation 50. Succeeding operations on this housing require all the available machine time; these machines are therefore colored red. Not until operation 160 do the three housings again go over the same machine.

After operation 40 the blue and yellow housings are delivered to an inclined rack leading to operation 50, rough turn ends. Succeeding machines in this line work upon both housings, and again the machine space is colored to show the portion of the hour required for each of the two housings – in this case an equal portion – 20 per hour.

The amount of information contained on this layout drawing is further illustrated by what happens after operation 160 where all three housings go over the same machine. The red housings are hung on an overhead continuous conveyor which carries them through the



Problem was to lay out department for straight-line production of four axle housings, with maximum use of machines and minimum handling. Color designations match colors on layout sketch (over) to indicate which housings go over which machines



Inclined racks serve to move housings from job to job, also to hold small bank of work

washer at operation 170. The blue and yellow housings leave the same operation, 160, but are carried by the same conveyor to operations 170, 180, and 190. Then they go to the washer, 200. From washing they go to the double-deck rack for welding, 210; then through 220, 230, 240, and back to wash operation 250, and finally to inspection, operation 260.

Maximum of Information

This method of constructing a layout drawing is designed to convey the maximum of information with the minimum of written description. Additional items of information included on the drawing may be mentioned. The inclined racks noted at various points serve to move housings from one operation to the next. The racks serve to hold a small bank, and temporary failure of one machine will not delay succeeding operations.

Dotted lines are used on the drawing to indicate overhead conveyors. The *E* in a small rectangle designates an electric hoist. Small rectangles colored black are hoists. Housings weigh up to 150 pounds in the rough, but operators have no lifting to do. In fact, women are employed on many of the machining operations.

Prior to laying out an operation like the one discussed here, a manpower analysis is made. Operations are lined up so that each operator has about the same amount of work to do. Operations are taken from one and given to another until the best balance is obtained. Supplementary operations are noted on the drawing. Operation 105, for example, is noted as the responsibility of the worker on machine 110; the same holds for the worker on machine 70 who must do operation 80.

It has been mentioned that, on machines that handle two or three different housings, the kinds may be run in succession one after the other. This is possible because the machines have been tooled with universal locating fixtures to handle the different housings. It works somewhat better from a scheduling point of view, however, to have one shift work on one kind and the second shift on another.

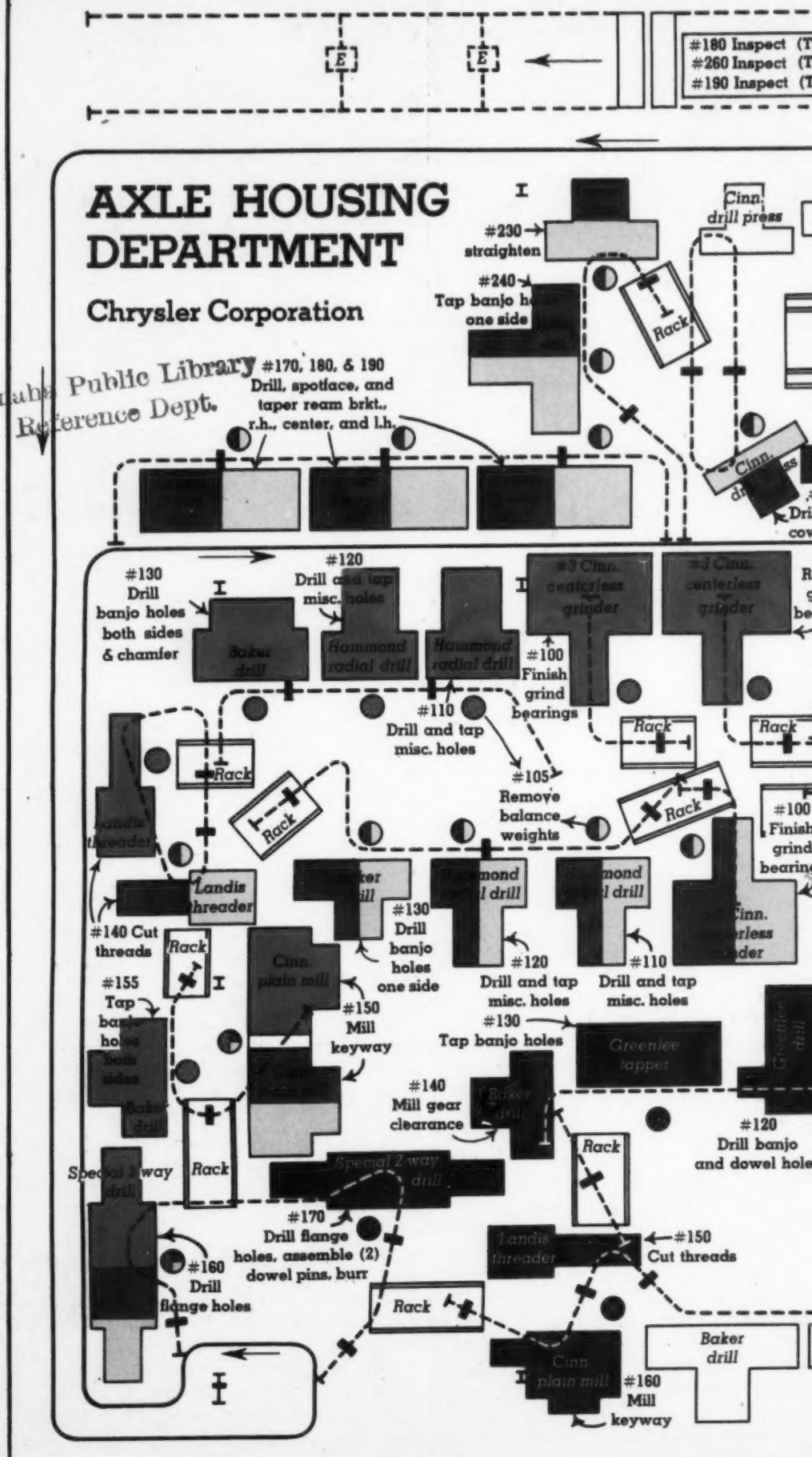
The physical layout of equipment with the accompanying manpower analysis is designed to make maximum use of machine capacity. The drawing here illustrated is intended to convey the maximum of information about this layout — what machines are common to more than one part, and what portion of machine- and man-time is devoted to each product where different parts are run over the same machines.

Limiting walls and machines used for other parts are shown in such unit layout drawings to indicate why certain moves were not made. In this unit drawing, for example, the washer is located out of the regular sequence, but enough surrounding information is indicated to show that room is not available elsewhere.

Minimum of Verbal Explanation

Perhaps a final advantage of these unit drawings should be mentioned. They are of convenient desk size and may be carried from office to office when information must be conveyed to concerned parties. Information does not have to be written, and a minimum of verbal explanation is necessary.

SEE OTHER SIDE FOR LAYOUT SKETCH


#180 Inspect (T
#260 Inspect (T
#190 Inspect (T
AXLE HOUSING DEPARTMENT
Chrysler Corporation
#230 straighten
Cinn. drill press
#240 Tap banjo h one side
Rack
#170, 180, & 190 Drill, spotface, and taper ream brkt., r.h., center, and l.h.
#130 Drill banjo holes both sides & chamfer
#120 Drill and tap misc. holes
Baker drill
Hammond radial drill
Hammond radial drill
#3 Cinn. centerless grinder
#3 Cinn. centerless grinder
#100 Finish grind bearings
#110 Drill and tap misc. holes
#105 Remove balance weights
Rack
Landis threader
#140 Cut threads
#130 Drill banjo holes one side
#120 Drill and tap misc. holes
#110 Drill and tap misc. holes
#155 Tap banjo holes both sides
Cinn plain mill
#150 Mill keyway
#130 Tap banjo holes
Greenlee tapper
#140 Mill gear clearance
#120 Drill banjo and dowel hole
Special 2 way drill
#170 Drill flange holes, assemble (2) dowel pins, burr
#150 Cut threads
#160 Drill flange holes
#160 Mill keyway

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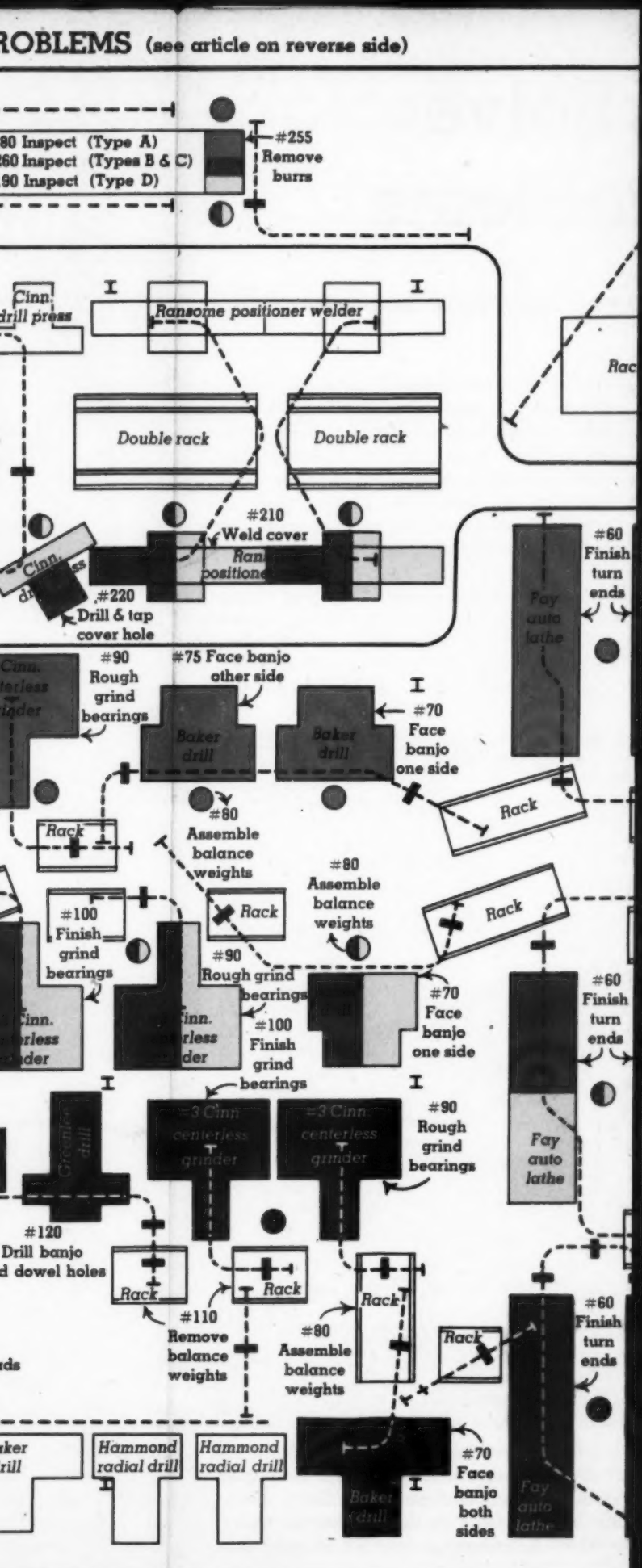
ROBLEMS (see article on reverse side)



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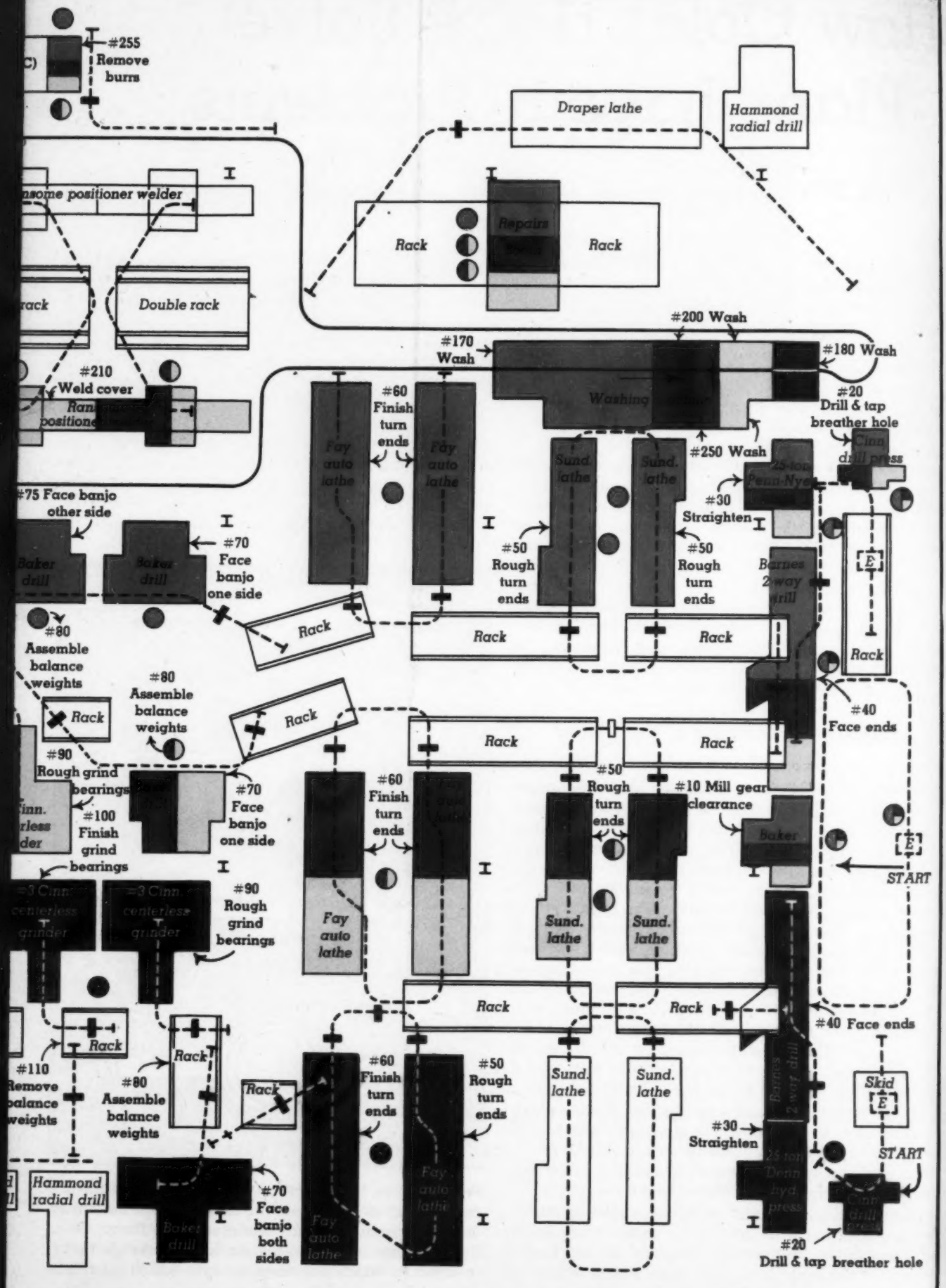

Starting a Training School From Scratch

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THOMAS G. NEWTON, Supervisor of Training, Armstrong Cork Company, Lancaster, Pa.

"Set up an aircraft school to train 3500 men and women, plus replacements." That was the production department's request of the general training section two years ago.

At that time the situation was briefly this: Fewer than 50 employees were learning how to make wing tips for a large airplane. It was their first experience in aircraft work. None of them could be made available as instructors in the new school. No experienced aircraft workers were available in the area. No tools were available for training. No space was ready for the school. And time was short. It was a discouraging picture.

In the advanced fabrication course trainees are taught how to re-form aluminum parts, get experience on shears, routers, brakes, drills

Policies Were Set

One of the bright spots was the program of evening aircraft instruction courses operating with production equipment during off-hours. This gave us a group with preliminary training to carry us for two months. We were familiar with the training schools of some of the leading eastern aircraft manufacturers from a previous survey. Therefore, we had specific policies in mind regarding the type of training project we wanted to start.

One of the most important policies was the determination that training projects should duplicate as nearly as possible actual operations in the manufacturing department. Trainees would make parts similar to those found in production. Courses would be short and intensive, designed to train people in the fundamentals of a specific craft, to be followed with a definite on-the-job training program in the manufacturing department, under operation instructors. The training methods employed were to permit trainees to complete their training on an individual basis, rather than hold individuals back with the group. A definite outline of the course of instruction, together with instruction manuals, was to help bring about this situation. We were to work in cooperation with the local school district and the state department of public instruction in supporting the training program.

All this has now been done. Instruction began on schedule, and more than 2000 people have been trained in our school.

Because of the priority situation, one of our first steps was to list the equipment and tooling required, place orders, and initiate priority requests. This we did with assistance from an aircraft manufacturer for whom we were going to do subcontract work. At the same time, we decided to use a warehouse space as the school location. Immediately, the engineering department joined us in preparing the plan for alterations and requesting the necessary priority for the building changes. It required lighting, plumbing, heating, and locker-room facilities. These steps were taken first because we knew that it was right here, delays beyond our control might be experienced.

The next problem was the matter of instructors. We needed fourteen at the start, and had none. A canvass was made of the organization to locate men who had mechanical backgrounds or who were used to working with tools. Those selected had the capacity to instruct and a desire to enter aircraft work. We kept in mind the essential requirements of the state department of public instruction for emergency vocational teaching certificates, because our instructors were to become school district employees.

Worked in Plant

Arrangements were then made with an aircraft company with which we had subcontracts, to give our potential instructors an opportunity to work in its plant on operations that they were scheduled to instruct. Fortunately, this training was exceptionally good, because a well-organized training program for subcontractor's personnel was in effect.

With our group we sent one man to act as training coordinator to make certain that each man actually received the training scheduled for him. This man conducted many evening discussion sessions at the hotel where our men were housed. Here many ex-

After completing basic exercises in various types of drilling and riveting, trainees learn how to subassemble and assemble fin parts

In the inspection course all parts made in the school are carefully checked, using the same system that is employed in the factory

changes of ideas occurred. This part of the program lasted from three to four weeks.

Then each man spent an additional week acting as assistant instructor in one of the aviation schools in New York state. These arrangements were made through the state aviation advisor. We also secured the services of a man with long aviation experience, to act as the head of the school, who stayed with us during the first year.

We were now ready for the next step—the organization of the specialized courses. Five courses were planned, representing to a great extent the departments of an aircraft manufacturing operation. The fabrication course was designed to teach trainees how to make detail parts. They make the parts required for the fin. In doing so, they get some experience on shears, routers, brakes, hydropresses, drills, and stretching machines, and a great deal more experience in the reforming of parts and in the use of many hand tools.

The course on riveting and assembly, after completing basic exercises in the various types of drilling and riveting, teaches trainees how to subassemble and final assemble the various fin parts made by trainees in the fabrication course.

The inspection course trains inspectors by having them inspect all work produced in the school, using the same system that is employed in the factory. Trainees for this course are selected from among those completing other courses with better than average records.

The jig and fixture course trains helpers by having them make all templets and jigs required by the other courses. They produce many small tools required in production, and have, on occasion, built several special machines and tools.

The blueprint reading course is given to all trainees making above average performance records in the other courses. It is required for all taking the jig and fixture and inspection courses, and for those who are expected to become supervisors and operation instructors.

In the normal operation of the school, it has been possible to train several persons for toolroom, stockroom, and small tool repair.

Quality Plus Speed

Not only is the element of quality stressed during training, but also that of speed. Budget times are set for each phase of the courses, and trainees proceed to the next block of instruction after they have completed the previous one. Working against the budget time keeps the question of speed in front of them. It is not stressed, however, to the detriment of quality. This plan serves to identify the fast and slow individuals. Grades on speed, quality, and related information give a clear picture of the progress of the trainee.

Complete manuals are now available for each course. They have been revised several times to bring the training in line with that required by changing conditions in the factory. Lately, advisory committees of production supervisors and school instructors have been appointed. Their purpose is to serve as coordinating agents to insure that the school is continually meeting the training needs of the various production departments.

The aircraft training school is the product of cooperation within the organization, willingness of prime contractors to help their subcontractors, and of school district and state officials being ready to help industry initiate training for new fields required by war conditions.

How Tests Can Strengthen the Training Program

C. H. LAWSHE and JOSEPH TIFFIN, Division of Education and Applied Psychology, Purdue University

MODERN TRAINING PROGRAMS are being strengthened and improved through the use of psychological tests. Industrial training directors are finding that such tests can answer three questions: (1) Who should be trained? (2) Where should training begin? (3) Has the training been adequate? Partial answers to these questions can be obtained without the use of tests, but a well-directed testing program can greatly improve the "batting average" of the training director, the personnel manager, or the plant superintendent who may be charged with the responsibilities of the training function.

1. Who Should Be Trained?

People differ markedly in their ability to learn, in their ability to use their hands, in their physical qualifications, and in their interest in a particular job. Through tests it is possible to identify those persons who have greater than an average chance of succeeding on a particular job. Thus training time, labor turnover, and production costs can be reduced, and training can be made more effective. In addition, the person who can do the job well is usually more contented, and this favorably affects the general industrial relations of the plant.

Occasionally the opinion is voiced: "We need everyone that we can hire in these times. There is no point in testing, because we've got to use everyone who is willing to work." Statements like this imply a point of view that is founded on fiction rather than fact. They assume that a person is "good for all jobs" or "bad for all jobs." There is no scientific evidence to support such a contention; in fact, the evidence shows that a person may have a great deal of aptitude for some types of work and little or no aptitude for other types. The job that testing can do is not to select the "good" applicants, but to select the applicants who are "good for a particular job."

This is well illustrated by the varying visual demands of different jobs. Close, fine work—such as radio tube assembly—requires keen near visual acuity. The operator's keenness of vision at greater distances is relatively unimportant. The following summary shows the facts as revealed in a visual survey of 225 employees in the tube assembly department of a tube manufacturing plant:

Distance visual acuity—Among the half of the operators who tested highest, 49 percent were above average in production. Among the half of the operators who tested lowest, 60 percent were above average in production.

Near visual acuity—Among the half of the operators testing highest, 68 percent were above average in production. Among the half of the operators testing lowest, 34 percent were above average in production.

Twelve applicants for jobs are taking the pegboard test at one time

This job clearly requires keen near—not distance—visual acuity. Among employees who *fail* a standard distance acuity test, a larger percentage succeed in learning this job well enough to produce above the departmental average than among employees who pass the distance acuity test.

The near visual acuity test showed exactly opposite results. In many other instances an applicant may be unsuitable to learn one job and well qualified to learn another.

Tests should be thought of, then, as employee allocation instruments and not as selection instruments.

How successfully can tests be used to identify persons who are likely to succeed in a given training program?

Figure 1 illustrates the practical op-

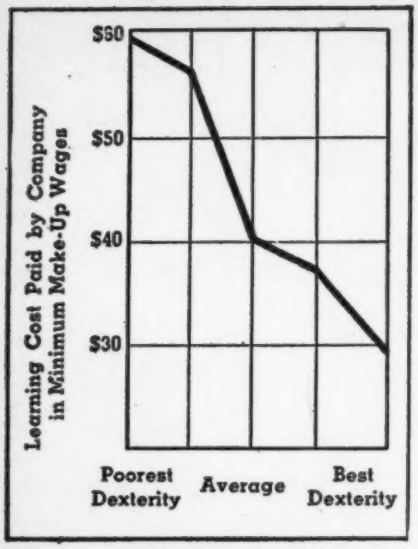


Figure 1. Relationship between scores on a finger dexterity test and average learning cost to the plant in minimum make-up pay

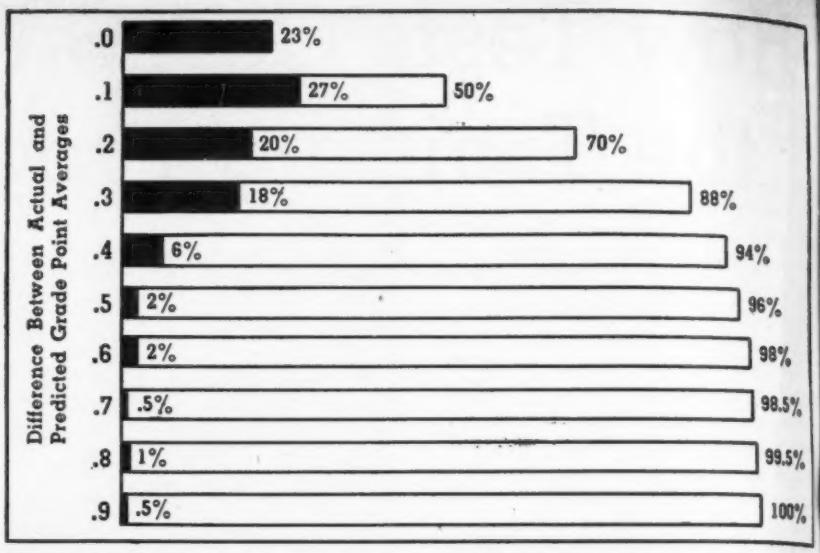


Figure 2. Graph shows accuracy of predicting performance from test scores. Solid bars are percentages of differences between predicted and actual grade point averages. Total length of the bars shows the proportion of differences falling below various limits

eration of this principle. Since the passage of the Wage-Hour Law, all employees must be paid a minimum wage. When new employees are paid on a straight piecework basis, they seldom actually earn the minimum hourly wage that must be paid. While new employees are learning the operation, the company must make up the difference between what the employee actually is worth and the amount he must be paid. The rapid learner quickly makes the rate whereas the slow learner requires a longer training period before he pays his own way.

One way to evaluate the training or learning costs of a new employee is to determine how much the company must contribute in minimum make-up before the employee is making the rate. Figure 1 shows the company contribution in minimum make-up wage for employees who score at different levels on a dexterity text.

It will be noted that the employees with poorest finger dexterity, as measured by a simple pegboard, cost the company an average of $59 each in minimum make-up before they made the rate. It will be further noted that the employees having the best finger dexterity cost the company, on the average, only $36.40 before they made the rate. This illustration is one of many practical examples of the direct financial gain which follows a placement program based on suitable tests.

Figure 2 further demonstrates the fact that it is possible to predict how well individuals will succeed in a training program. Sailors entering an electricians' training program were tested before the training began.[1] On the basis of these preliminary test scores, estimates or predictions of final grades (grade point averages), which are issued 15 weeks later, were made. A "perfect" grade is 4.0; 2.5 is considered failing; and some trainees receive grade point averages as low as 1.9 or 2.0.

Figure 2 charts the difference between predicted grade point averages (on the basis of preliminary tests) and actual grade point averages (15 weeks later). As will be noted in the figure,

[1]C. H. Lawshe, Jr., and G. R. Thornton, "A test battery for identifying potentially successful naval electrical trainees," *Journal of Applied Psychology*, October 27, 1943.

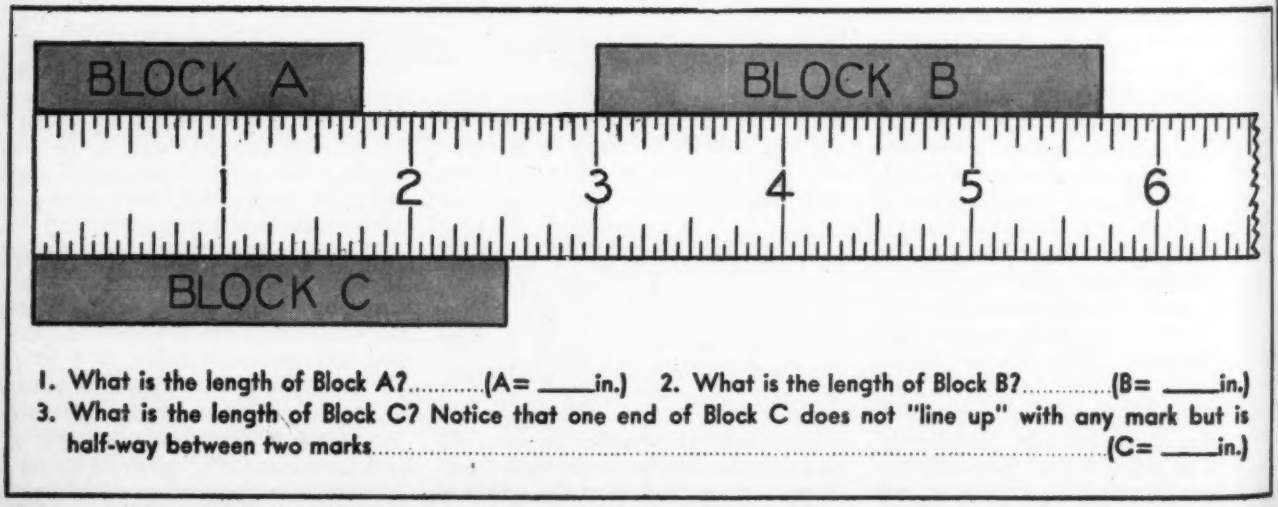

BLOCK A
BLOCK B
BLOCK C
1
2
3
4
5
6
1. What is the length of Block A?.....(A= ____in.)
2. What is the length of Block B?.....(B= ____in.)
3. What is the length of Block C? Notice that one end of Block C does not "line up" with any mark but is half-way between two marks.....(C= ____in.)

Figure 3. "Everybody" does not know how to read a scale. Out of 650 applicants, 70 percent could not read to a thirty-second, 54 percent missed the sixteenth, 20 percent could not read to a quarter inch

23 percent of the grade point averages were estimated with no difference at all (0.0 difference), 27 percent were predicted with a difference of 0.1, 20 percent with a difference of 0.2, and so on. To look at the figure further, 50 percent were predicted with a difference of 0.1 or less, 70 percent with a difference of 0.2 or less, and it was possible to estimate the grade point averages of 88 percent of the trainees within 0.3 points. To the extent that it is possible to identify the potentially successful trainees in advance, it is possible to increase the effectiveness of the training program.

Tests for the allocation of applicants or employees have sometimes failed because of the improper use of tests or the use of improper tests. A test might be highly successful in one situation and yet be of little value in another. However, when an actuarial approach to the problem is employed, tests can be used to great advantage.

2. Where Should Training Begin?

All too frequently the assumption is made, "Everybody knows that," or, "Everybody learns that in the eighth grade." The facts are: (1) Everybody does not learn "that" in the eighth grade, and (2) of those who do, many forget before they have the occasion to apply or use the information or skill. One of the fundamental rules of all instruction is *find out what the student already knows.* To spend time teaching a trainee something he already knows, is a waste of time and is frequently boring to him. Not to teach him something that he needs but does not know, is to insure failure of the training program.

Figure 3 reproduces a picture and three questions from a widely used industrial test[2]. The reading of a scale or a rule is a skill which many job trainers and supervisors assume is so simple that "everybody already knows it." There is considerable evidence to the contrary. Approximately 650 female applicants for jobs in a machine tool plant were given this test at the time they were hired. There is no reason to believe or assume that these women were any better or poorer than the usual inexperienced applicants. Their ages ranged from 18 to above 60, and their education ranged from the sixth grade to two years in college. When the test results were tabulated, it was found that in reading the scale

[2]C. H. Lawshe, Jr., and A. C. Moutoux, *Industrial Training Classification Test*, Purdue Vocational Test No. 1. Science Research Associates, Chicago.

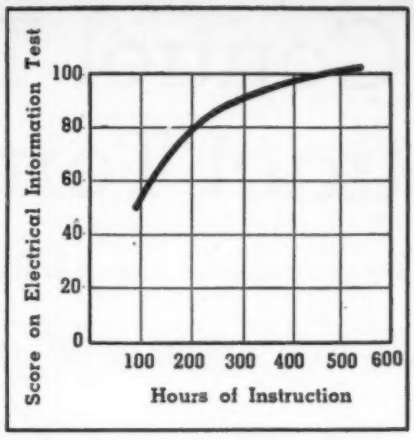


Figure 4. Graph indicates the relationship between length of training period and scores on an electrical information test

to ¼ inch, 20 percent missed; reading the scale to 1/16 inch, 54 percent missed; and reading the scale to 3/32 inch, 70 percent missed.

These applicants were to be trained as machine tool operators. Reading gages and scales is necessary from the outset in this work. Yet 70 percent of the applicants were unable to read a scale to 3/32 inch. The training in this case must begin at this level. To begin it at a higher level would be literally equivalent to attempting to teach long division before the pupils knew how to add and subtract.

If applicants are to be given training or be placed on jobs where these basic and fundamental skills are essential, then programs designed to bring them up to the appropriate level of performance must be designed. Tests properly selected or constructed for a particular training situation answer the question, "Where should training begin?"

3. Has the Training Been Adequate?

The true answer to this question is the answer to the question, "Is he now able to come through on the job?" Unfortunately, we frequently cannot afford to take the risk involved in terms of time, scrap, or damage to equipment to answer the question by placing the man on the job without some previous estimate of his probability of success, based upon a measure of what he has learned in the process of training.

The objection is sometimes advanced that it is impossible to measure, by test questions, manipulative skills which a given trainee is supposed to have developed in the course of a training program. This is quite true; however, aside from manipulative ability as such, an intelligent use of manual skill rests upon a certain amount of factual information. In electrical maintenance, ability to solder is of little use unless one knows which wires to solder. Knowing such facts as how to determine the polarity of a circuit, how large a load a given circuit will carry safely, and whether a particular instrument is intended to measure direct or alternating current, presupposes a knowledge of such things as resistance, impedance, voltage, amperage, and numerous other concepts. Knowledge of these concepts can be measured by paper and pencil tests.

Below are three typical questions drawn from a test[3] designed to measure achievement or knowledge in the field of electricity. The person taking the test writes the number of the correct answer in the space at the right. With this form of test question, a clerk with a scoring key can score the paper.

1. A bathroom fixture should never use a brass shell socket because it may (1) short circuit and blow fuses, (2) draw excessively high currents, (3) give one a dangerous shock, (4) become corroded and open circuit. . (—)

9. The core of an electromagnet is made from (1) hardened steel, (2) soft iron, (3) tool steel, (4) a nickel iron alloy. . . . . (—)

19. A watt-hour metal reads 9784 kwh. one month and 9847 kwh. the next; at 7 cents per kwh., the bill would be (1) $2.98, (2) $3.41, (3) $4.41, (4) $5.65. . . . . (—)

That performance on items such as these is related to ability to do a job, is demonstrated by the information presented in Figure 4. Approximately 300 individuals who had been given varying amounts of practical electrical training were tested with one form of this test, and their scores were plotted against the amount of time they had been in training. The curve presented in Figure 4 is the result; the relationship shows an improvement in knowledge with an increase in training time.

Tests of this sort are *practical.* They deal specifically with the job to be done. They measure what the employee "needs to know"—not what is "nice to know." They give the training director a concise and accurate analysis of who will succeed on training for different jobs, where the training should begin, and when the trainees are qualified to leave the training class and go into production.

[3]C. W. Caldwell, H. R. Goppert, H. G. McComb, and W. B. Hill, *Test for Electricians*, Purdue Vocational Test No. 3, Technical Information Series. Science Research Associates, Chicago.

Materials Control That Will Aid Contract Termination

B. H. HELLMAN, Control Supervisor, Atlas Aircraft Products Corporation, New York

TWO MAIN CONSIDERATIONS dictate close control of materials in individual plants with war contracts:

1. The manufacturer must be sure he has *enough* materials. The demand for the final product is so urgent and the time schedule so telescoped that, in the face of widespread shortages of raw materials and finished components, errors are likely to mean disastrous delays in the shipping of products that cannot be spared.

2. With contract terminations imminent, the manufacturer must be sure he does not have *too much* material. No one wants to be caught at the end of the war with several million dollars of unsalable inventory.

Add to all this the heavy demand made by governmental agencies concerning the reporting of inventories and of manufacturing costs, and the need for a good materials control system is self-evident.

New companies, or companies entering new phases of manufacture as a result of the war, face still other difficulties. They are forced to organize and produce all at once, so to speak. Their position is one in which scheduled deliveries must be made almost simultaneously with estimates of requirements and investigation of the sources of materials.

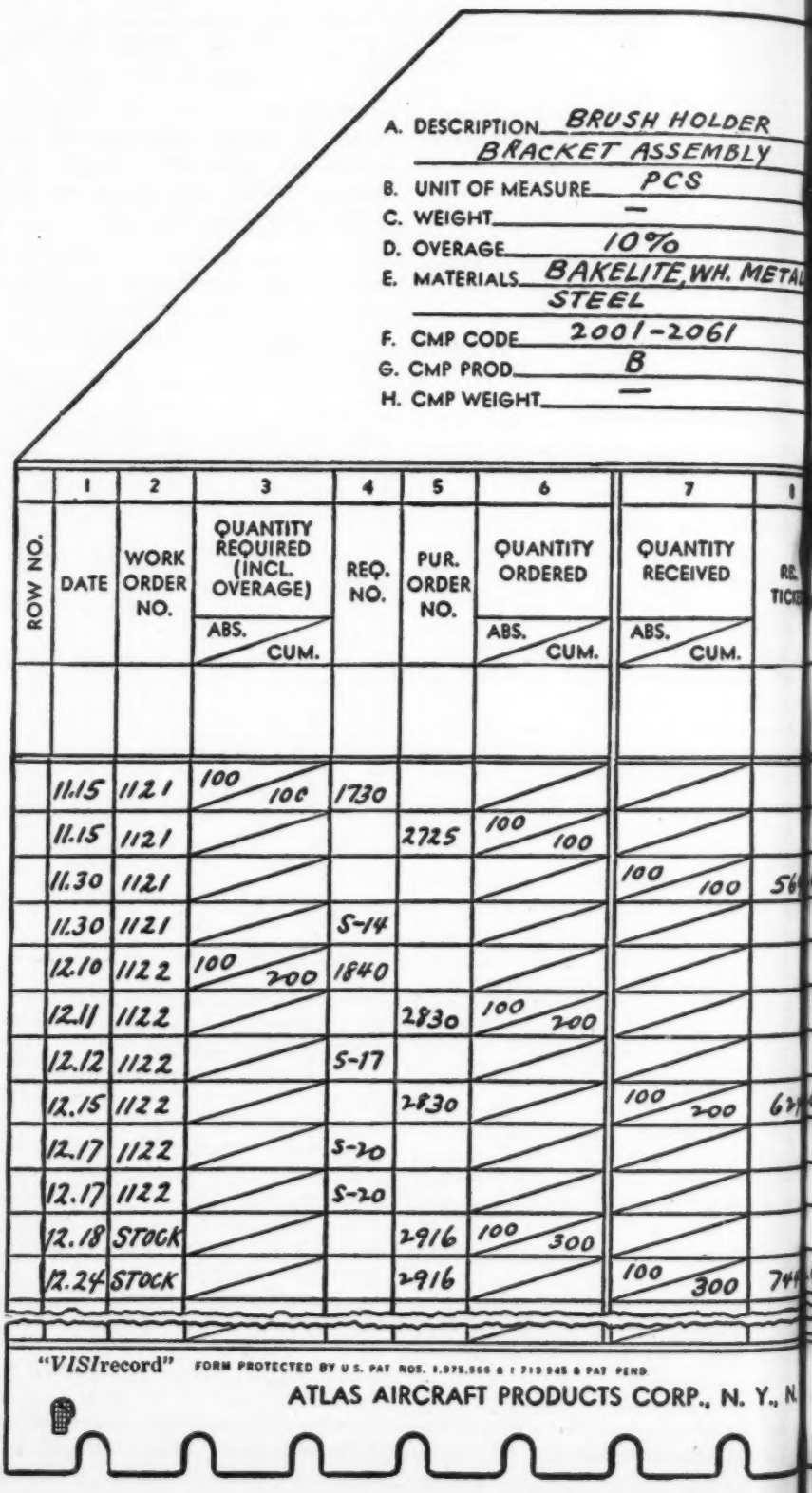
To Prevent Stoppages

This, generally, was our situation at the outset of the war. We were beginning manufacture of an extremely complex set of final products vitally needed by the armed forces, but were never able to reach plant capacity because there were always stoppages of one sort or another caused by failure in deliveries of materials by suppliers.

In the process of attempting to bring about some order, we devised a materials control system which we consider worth bringing to the attention of other manufacturers. It provides:

1. An automatic method of preventing shortage.

2. A flexible system of receiving and issuing materials against given contracts or against stock.



A. DESCRIPTION BRUSH HOLDER BRACKET ASSEMBLY
B. UNIT OF MEASURE PCS
C. WEIGHT —
D. OVERAGE 10%
E. MATERIALS BAKELITE, WH. METAL STEEL
F. CMP CODE 2001-2061
G. CMP PROD B
H. CMP WEIGHT —

ROW NO.	1 DATE	2 WORK ORDER NO.	3 QUANTITY REQUIRED (INCL. OVERAGE) ABS. / CUM.	4 REQ. NO.	5 PUR. ORDER NO.	6 QUANTITY ORDERED ABS. / CUM.	7 QUANTITY RECEIVED ABS. / CUM.	8 REC. TICKET
	11.15	1121	100 / 100	1730				
	11.15	1121			2725	100 / 100		
	11.30	1121					100 / 100	56[illegible]01
	11.30	1121		S-14				
	12.10	1122	100 / 200	1840				
	12.11	1122			2830	100 / 200		
	12.12	1122		S-17				
	12.15	1122			2830		100 / 200	62[illegible]02
	12.17	1122		S-20				
	12.17	1122		S-20				
	12.18	STOCK			2916	100 / 300		
	12.24	STOCK			2916		100 / 300	74[illegible]02

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ATLAS AIRCRAFT PRODUCTS CORP., N. Y., N.

3. A first-in, first-out materials costing system.

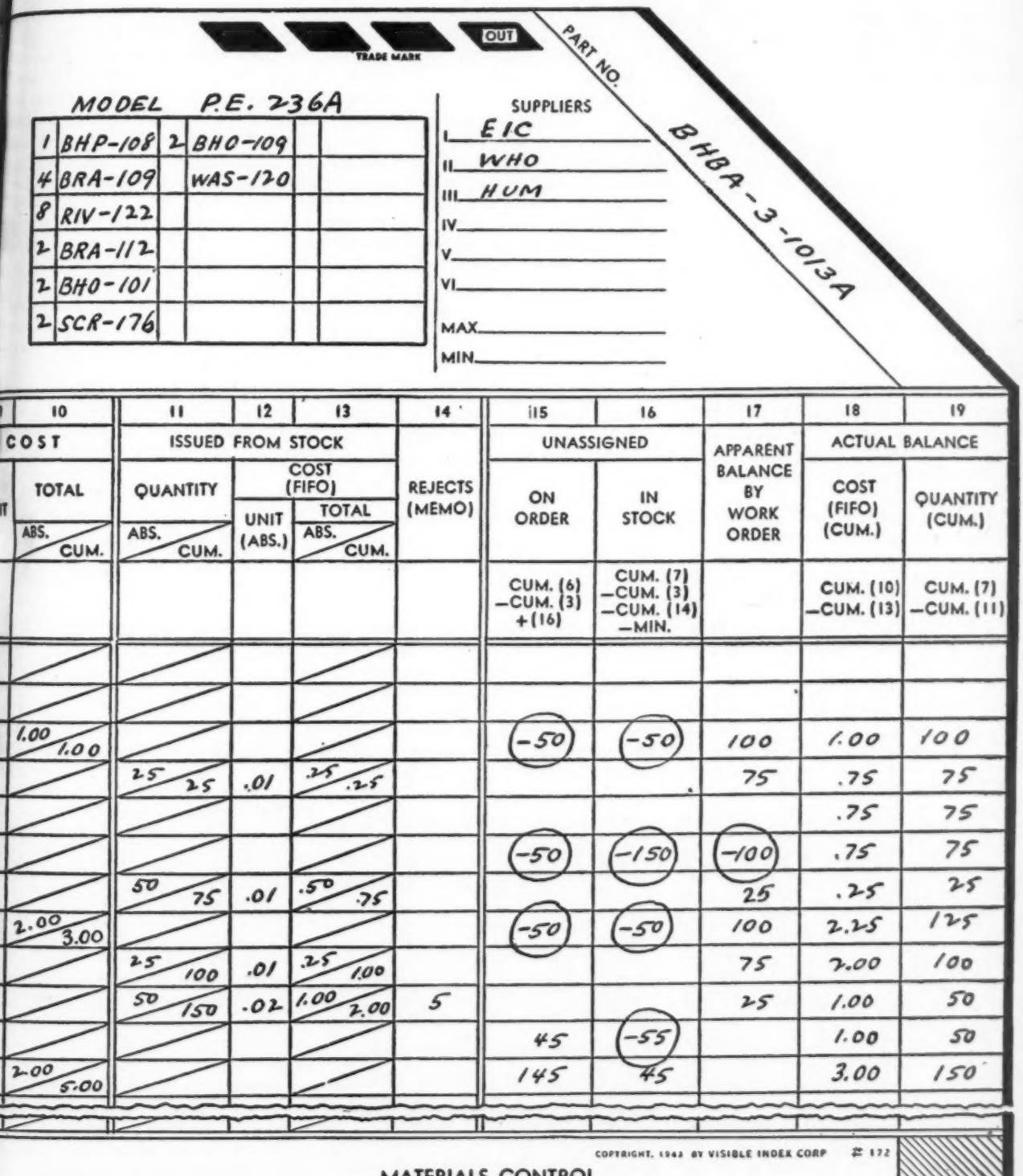
4. Automatic stock balances by formulas on the control card.

5. General information for estimating contract requirements, ordering, and reporting to the government.

We set up our forms on visible index cards so constructed that a bank of 20 to 30 cards can be seen at a glance. Each card, moreover, has a visible margin which enables one to see the actual balance without pulling the card from the file.

Now, assuming that a contract is received, let us follow the manner in which fulfillment of requirements is provided for by this system. The first entry, after the date and the contract or work order number, is the quantity of the given part necessary for the completion of the contract. This includes, over and above the actual number of such parts going into the end-product, the number required in order to make up for rejections, loss, spoilage, etc. (column 3 in illustration).

After entering this information, the materials control department issues



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MATERIALS CONTROL

requisitions for the required amount of materials, and the requisitions are routed to the purchasing department which, in turn, issues purchase orders to suppliers on the basis of these requirements. This, by the way, constitutes a check on purchasing, since every requirement noted on the card (column 4) should be followed by a purchase order.

It will be noted that certain columns are split. This split makes it possible to post the quantity (absolute) required and ordered on the single entry in the upper half of the column and the total (cumulative) of all entries in the lower half. Thus, it is never necessary to add up a whole column in order to get the total. All you do is add the last single entry to the preceding cumulative.

Costing System

In our costing system we elected to use the first-in, first-out method because it is conservative, keeps abreast of market fluctuations, and eliminates the necessity for working with weighted averages. It involves assigning a unit cost to each receipt and then costing issuances in chronological order so as to exhaust the oldest stock at the oldest prices before going on to newer stock at later prices.

In the example given on the card, this is made clear. The unit cost of our first receipt is $0.01 (column 9) and 100 parts are received. The total cost of the receipt (column 10) is thus $1. Upon issuing this part from stock, we must therefore price the first hundred at $0.01. But suppose the unit cost of the next hundred were $0.02 and that our issuances were made in this fashion—25, 50, 75. In such a case the issuances of 25 and 50 are of course made at $0.01, but the issuance of 75 is broken up, and 25 are priced at $0.01, while the other 50 are priced at $0.02. The cost of all our issuances is therefore $2, and this is written in the lower half of the split in column 13 on the last line used.

In order to find the cost of the actual balance (column 18) on the basis of these receipts and issuances, all you have to do is subtract the last cumulative figure in column 13 from the last in column 10.

Since the formulas for derivation are given on the card, no memorization is required on the part of the clerk who makes the entries.

Some of the most elementary and important necessites in manufacture for war are: (1) To have on tap an indication as to whether you have ordered out on everything; and (2) to have indications as to whether you have everything you need in the house. And you must know at any time how far away you are from realizing these two conditions.

This information, among other things, is provided for in the "unassigned" columns. When these are negative, the above conditions have not been fulfilled, and the magnitude of the deficiency is given immediately (see columns 15 and 16). When the figure is positive, it indicates that there are reserves for use on new contracts. This is important because of the brief interval often encountered between the letting of a contract and its scheduled delivery. In order to draw on reserves, it is essential that you know exactly how much reserve or unassigned stock you have, and also how much of the material on order but not delivered is unassigned.

The formula in column 16 involves, in non-mathematical terms, subtracting the requirements, the rejected material, and the minimum from the amount ordered. The formula in column 15 involves subtracting the amount required from the amount ordered and then adding the sum of column 16 in the same row.

In a great many cases, these two unassigned columns will contain minus quantities. The figures are then entered in red (see circled figures in illustration), and a signal is placed on top of the card indicating that action must be taken to remedy the deficiency.

The necessity for costing by contract imposed under present-day conditions makes it important to apportion materials on hand among the contracts in force. To do so simplifies costing itself and lightens the burden of reporting on costs to the various government procurement agencies. Moreover, a breakdown by contract is indispensable for satisfactory contract termination. To provide for this, a breakdown of the actual balance is given in column 17.

This column has still another function. When a contract comes up and there has not been sufficient time to order out on it, requirements will have to be borrowed from others, and these borrowings are posted as minus quantities indicating that replacements must be made as soon as possible. In this connection, the reject column (14) also provides for a check on replacements by giving information on material issued which is not up to specifications. There are, therefore, several checks on requirements and reserves—i.e., unassigned figures, apparent balance by contract, and rejects.

To facilitate purchasing, one must have exact information as to suppliers, specifications, and CMP restrictions. We provided for these at the top of the card. The blank box at the top center of the card is used for itemizing the constituents of a subassembly in cases where these are processed within the plant. Next to it is a list in code of the chief suppliers.

Static Items

Just below this list occur two of the most important static or relatively static items in the system, the maximum and the minimum. The latter, it will be remembered, figures directly in the calculation of unassigned stock. Setting the minimum depends on such factors as lead time, purchase price, and the market breakpoints for varying quantities. Whenever stock falls below the minimum, the unassigned in stock is a minus figure and indicates that further ordering or more efficient expediting is necessary. The maximum, on the other hand, insures against having inventories that are too large from a legal or economical point of view, and is affected specifically by such considerations as the expensiveness of the item, limitations of space, governmental restrictions, and, last but not least, the likelihood of cancellations.

Such a materials control system, while it does not enable the user to control suppliers, does effectively reduce in number and intensity the headaches caused by war shortages. For one thing, it permits practically automatic re-ordering. For another, it dovetails very nicely with production control and accounting systems. The task of gearing purchase orders to a production schedule and a budget is lightened enormously when one has a complete picture of inventories, requirements, and reserves, and can set an accurate value on inventory by simply totaling the costs of actual balances for all parts or materials. The present importance of setting up materials accounting of this sort in industrial plants can not be overemphasized. It will help insure against stoppages now and guarantee maximum reimbursement of costs when we come to the end of the war.

The American Way

The lower the production cost of industry's products, the lower the selling prices can be. Low selling prices stimulate widespread purchasing, which calls for large manufacturing orders, which provide extensive employment.

Here Is Industry's Verdict on Women Counselors

Omaha Public Library
Reference Dept.

THAT WOMEN COUNSELORS are doing a real job in helping to keep the women in the industrial army happy, contented, and productive on the job, is proved by the answers to a recent FACTORY questionnaire sent to representative plants all over the country. All but one of the respondent companies that employ counselors, or have employed them, are enthusiastic about their accomplishments.

In the ensuing report, we shall follow the simple procedure of asking the same questions asked in the questionnaire, slightly rephrased, and then summarizing—or, in some cases, listing in detail—the answers we received.

What are your women counselors like? Answers to the various parts of this question indicate that this is not a young woman's job. It requires poise, maturity, judgment, and a certain amount of educational background. The average age of the counselors employed by the companies answering the questionnaire is 40—with the youngest 26 years old and the oldest 50. Their scholastic background varies from 2 years of high school to a doctor's degree. They have worked previously as operators in the shop, as personnel women, social workers, nurses, teachers, actresses, and dress shop owners.

Typical answers follow:

One college graduate with teaching experience; one with 2 years of college training and personnel experience; one with 2½ years of high school and with experience as a dress shop proprietor and as an interviewer in charity bureau and community service club work.

College graduates, most of whom have worked in either production or personnel office.

High school graduates and graduates of business school. We have one registered nurse, several with nurses' training, one trained social worker, a top personnel woman, an actress, a singer, a dancer, an executive secretary, a teacher...all have had experience dealing with people and are attractive, with good personalities.

One who is highly successful has had years of experience operating a nursing home for children. She finds this useful, as many problems are merely those of "grown-up children."

Previous work experience in our plant. Generally upgraded because of ability to get along with people and respect of associates for them.

No preference for specific occupational background; poise, human interest, sincerity, warmth of personality, understanding, and judgment are essentials.

Psychiatrist, graduate M.D. Johns Hopkins; sixteen graduate registered nurses, or college; four social workers, all high school graduates.

Minister's wife, in charge of women's work in churches for 25 years.

Which department in the plant "pays" for women counselors? Most plants (83 percent of those replying) charge the cost to personnel or industrial relations; in one plant the counselor reports to the factory superintendent; others are on the administrative staff or assigned to "labor relations."

Only 66 percent of the counselors have private offices. Other share offices in the personnel department or have desks in the shop. Most of them (87 percent) are available at any time for consultation, although in some instances appointments have to be made for night-shift workers.

Do the counselors have other duties? All but one of the companies that answered this question said "yes." These duties include interviewing candidates for jobs; editing a plant paper; talks before outside groups on "women and defense"; maintaining absentee control; nursing; keeping records of cases; checking state laws regarding employment of women to see that they are complied with in the plant; lecturing on safety, company rules and policies, nutrition; serving on employee cafeteria committee; introducing women employees to their foremen. In 50 percent of the companies reporting, counselors conduct exit interviews.

One company—an aircraft plant employing thousands of women—describes the additional duties of counselors thus:

Counselors talk to women in groups about many different things. If many new women are coming into a department, it would be called an induction talk. If an incident occurs that is upsetting, we call

Poise, judgment, ability to inspire confidence, are among the characteristics required for a successful counselor. Above, left to right, Miss Grace Hadden, Wolverine Tube, Detroit; Miss Barbara Hoover, Perfect Circle, Hagerstown, Ind.; Mrs. Doris Pierce, American Optical, Southbridge, Mass.

the counselors together and discuss it. In our opinion, this is a very valuable function of a counselor, because it not only improves relationship between counselor and employee, but also between employees themselves. It also tends to stop rumors and is good for morale. Counselors keep some confidential records only for their own purposes, in order that they may know the background of an employee.

An important function is checking restrooms for ventilation, overcrowdedness, and so on. In the restrooms the counselor maintains a bulletin board, informing women of new facilities for child care, new rules, and the like.

Another airplane manufacturer says:

Because of the variety and extensiveness of our personnel counselors' activities, they have not been able to give as much attention as we should like to the emotional or psychological problems of the workers. Recently, therefore, we set up a group, which we have called "employee consultants," to specialize in this phase of morale building.

The counselor organization acts as advisers to employees on all matters—occupational, domestic, recreational, financial, etc., except specific problems dealing with wages, hours, and working conditions, which, under agreement with the union, they may not discuss. They do not have time, however, for minute exploration of deep-seated emotional disturbance.

In contradistinction to the counselors' field of service, the function of the employee consultant is confined exclusively to the exploration of emotional problems, most of which have their roots in conditions and circumstances outside the employee's occupational sphere. In short, the consultant's responsibility is to develop more effective workers by the resolving of psychological disturbances that short circuit their interest in, and effectiveness on, the job. Their range of service, of course,

How Respondent Companies Voted on Women Counselors

	Percentage of replies		
1. Do women counselors really			
(a) reduce absenteeism?	YES—72	NO—12	16*
(b) hold down turnover?	YES—84	NO— 4	12*
(c) keep grievances at a minimum?	YES—84		16*
2. Are counselors authorized to advise employees on occupational problems?			
(a) how to get more money?	YES—72	NO—20	8*
(b) complaints about supervisors?	YES—76	NO—20	4*
(c) complaints about working conditions?	YES—84	NO—12	4*
(d) complaints about fellow-workers?	YES—84	NO—12	4*
(e) requests for upgrading?	YES—64	NO—28	8*
(f) requests for transfer?	YES—80	NO—16	4*
3. Is it company policy to have counselors act to investigate and remedy occupational problems?	YES—64	NO—28	8*
4. Are women counselors authorized to advise with employees on personal problems?			
(a) marital difficulties?	YES—72	NO—20	8*
(b) affairs of the heart (if unmarried)?	YES—72	NO—20	8*
(c) family quarrels and conflicts?	YES—72	NO—20	8*
(d) debts and financial difficulties?	YES—76	NO—16	8*
(e) transportation?	YES—76	NO—16	8*
(f) housing?	YES—76	NO—16	8*
(g) child care?	YES—80	NO—16	4*
(h) health problems, family or personal?	YES—84	NO— 8	8*
5. With respect to personal problems is it the policy to have counselors attempt to take actual action and give assistance?	YES—28		
OR — do they mainly afford employees a chance to "talk themselves out" and find their own solutions?	YES—60		12*

*Did not reply to this question

"Attractive Women, With Good Personalities . . ."

Mrs. Esther T. Long, Ryan Aeronautical, San Diego

Miss Marjorie Newton, Allis-Chalmers, Milwaukee

Miss Geraldine Doheny, Minneapolis-Honeywell Regulator

Mrs. Aldona Bulota, Link-Belt Ordnance, Chicago

Mrs. Ramona Green, Picatinny Arsenal, Dover, N. J.

Miss Eileen Campion, National Union Radio, Newark

is kept well within the limits of clinical psychology, and does not invade the psychiatric field.

We have been engaged in this work for so short a time that conclusions are not possible. Indications, however, are that there will be an unchallengeable contribution to employee morale, with all that this implies in efficiency and productiveness.

Do counselors really reduce absenteeism, hold down turnover, keep grievances at a minimum? Most of the companies queried say a most emphatic "yes," especially as far as the second and third factors are concerned. These are typical comments:

Specific examples and interesting stories are available confirming all conclusions.

The counselor can determine the cause for absenteeism and turnover, and work on such of them as are her responsibility. These causes include worry over children, illness in the home, shopping difficulties, fatigue, dissatisfaction, clash of personalities of fellow-employees. On keeping grievances at a minimum, the counselor advises management of poor conditions, refers employee to supervision to correct situations not brought to his attention.

Counselors are a "must" in modern personnel administration.

Our turnover and absenteeism have been materially reduced. Our women counselors have contributed greatly to such reduction.

Are women counselors authorized to advise employees on occupational problems? Six problems were listed—how to get more money; complaints about supervisors, working conditions, and fellow-workers; requests for upgrading; requests for transfer. Just how the various plants covered in the questionnaire handle these situations can be seen from the percentages in the chart on page 126.

Is it company policy to have counselors act to investigate and remedy occupational problems? In 64 percent of the respondent companies, it is, in 28 percent, is not; 8 percent did not reply. The comments on this question were more enlightening than the bare figures might indicate:

We do not restrict counselors. They can discuss anything with employees. We believe we have selected counselors who are loyal to the company, and their objective to cause a more effective production rate from women, is attained in the best way they can work.

On complaints about supervisors, working conditions, and fellow-workers, counselor acts for and through management in consultation with line to correct such complaints, either through counseling, or, if a situation is unjust, by bringing it to the attention of the proper persons. Many requesting transfer do not want transfer, but need an adjustment in the department. The counselor will listen and determine the reason. If it is upgrading, she refers the case to the proper group.

Bring to the attention of the personnel manager the problems which should be investigated and remedied. On questions about wages, upgrading, and transfers, they advise the employee whom to see and the procedure to follow.

Counselors investigate only at the re-

quest of persons involved. Counselors have no authority to take action, but assist in obtaining action on problems.

Counselors are instructed not to short circuit foremen in their dealings with individual employees. The confidential nature of some contacts requires direct dealing, which the foremen understand.

Counselors act as fact-finders for management. Management takes any positive action indicated.

Our counselors do not in any way interfere with a supervisor in the operation of this department. It is the duty of the counselors to refer employees requesting answers to problems of occupational nature to the proper channels.

Women counselors are members of the personnel department and as such are fully provided with all necessary information and authority.

The counselors investigate the problem and make a recommendation for its solution to supervision. They then follow up to see if recommendation is carried out.

Counselor contacts personnel director for vital cases. Works with plant superintendent or chief inspector on routine cases.

Counselors may investigate but not take remedial steps without having first discussed the matter with the personnel manager and then only upon his specific authorization.

Are women counselors authorized to advise with employees on personal problems? Eight problems were listed, and chart shows how the answers ran. One company added a problem to this list—inter-racial—and stated that it had specialists to handle this and the child care and health problems.

With respect to personal problems is it the policy to have counselors attempt to take actual action and give assistance—or do the counselors mainly afford employees a chance to "talk themselves out" and find their own solutions? As indicated on the chart, counselors in 28 percent of the plants "take action and give assistance," whereas in 60 percent they "let the worker talk herself out and find her own solution."

In a great many instances it appears that the counselors act as intermediaries, or refer the employees to the proper departments or people for the help they need. But it would seem that in some plants at least the procedure is

Miss Mae E. Brenner, Armstrong Cork, Lancaster, Pa.

Mrs. Dorothy Lewis, North American Aviation, Inglewood, Calif.

Miss Helen Bolanowski, Revere Copper & Brass, Rome, N. Y.

WHAT A COUNSELOR OF

THE COUNSELOR'S JOB at B——— Corporation is to:

1. Know and understand women employees.

2. Help them with their working and personal problems.

3. Make easier the transition from normal home life to employment.

4. Assist supervisors in directing the work of women so as to help create the greatest possible understanding between women workers and management.

As a counselor you are employed to facilitate the work of the personnel office to conduct and adjust new employees to their jobs; and to assist all supervisors with their problems in relation to women employees, particularly in matters pertaining to conduct, health, clothing, and the observance of safety rules.

Remember! Suspend any judgment until all the facts of a given situation are at hand. If the matter is clearly out of your province, or if you have any doubts, conduct the employee to the foreman and offer your assistance in effecting a satisfactory adjustment. Complaints must be routed through the foreman to keep him informed and to help him retain the respect and leadership of his group.

You should be constantly alert in your field of observation to discover new ways in which women can be utilized in the plant.

On night shifts always keep the shift superintendent informed. He has full authority and will be expected to help settle problems that arise on his shift.

I. A log book will be kept by the counselors. The exchange at the beginning of each shift will be made in the personnel office. In this way a close contact can be maintained between the counselors and the personnel office. The log will record any problems with accompanying facts and solutions. No *confidential information* will be entered in this book... only the name of the employee with a notation "personal." The employee counselor has to make it completely plain that she is never "selling the employees down the river." Verbal discussion of each case with either Mr. J——— or the department head should follow up the written report.

II. The counselor will make two inspections of the plant per shift, shortly after the beginning and in the middle of the shift. She will visit the women's rooms and locker rooms, and check with the nurse at the dispensary regarding women employees absent from work. The primary purpose of this will be to prevent loitering and malingering to get out of active work. When someone is found

left up to the counselor herself. Note this reply:

Quoting two different counselors, "We do not merely allow them to talk themselves out. We attempt to give counsel, comfort, and make suggestions of a practical nature." Another "discusses the problem sympathetically with the employee, points out steps and consequences, and encourages the employee to make her own decision. Counselor might handle whole situation better than employee, but the risk of making workers emotionally dependent is too great." All effort should be to make employees independent and emotionally stable.

Here are more comments:

The counselor *listens* while she hears the whole story. She will then project the problem so that the employee may see herself. She will very often arrive at her own solution. The counselor may suggest (from her own experience) different solutions that would be helpful, depending entirely on the nature of the problem.

Act in consulting and advising capacity only. This is done on request of employee as result of feeling of confidence and friendship which has been built up.

Our counselor often aids in cases of garnishments and keeps close contact with local agencies which specializes in certain types of community service.

Referrals are given to employee service or medical department in our own company in all personal problems other than those involving marital difficulties.

From our experiences, counselors perform duties slightly different from most, in that they do not advise employees. Most people do not act as counselors advise, but may do the opposite. Our counselors listen to women and men, and try through the interview method to aid employees in solving their own problems. Essentially, the employee has worked out his own problem. The counselor through this method, has the trust of all, because they know she will not disclose to anyone what has been said.

We employ a woman psychiatrist, who may or may not give specific aid or treatment to maladjusted persons provided they are sufficiently valuable to the war effort.

Friendly advice in some cases; definite action in others. Our files contain a great deal of information pertaining to assistance that can be obtained through government and welfare agencies.

What is the ratio of counselors to employees? It varies so widely that an average figure is meaningless. The mean is approximately 1 to 750—but the range is from 1 to 70 to 1 to 3500.

The one dissenting voice in the general chorus of approval of women counselors came from an airplane manufacturing company, which had employed them, but had discontinued counselor service. Counselors are, it believes, "often the cause of grievances, because the union feels they interfere with union activities; they tend to become paternalistic; they try to bring out employee problems instead of trying to mitigate them." The service was abolished because, in this company's opinion, its value did not justify the cost.

WOMEN DOES —as outlined in one company's manual

to be apparently loitering, the counselor will talk to her at once. She should find out if the person is ill, and if so have her report immediately to the dispensary. If she is loitering, point out that she is needed on the job, that she is being paid for 8 hours of work but is actually working less. (Use extreme tact in putting this point across.) She should also visit regularly those departments where women in rather isolated locations might be nervous or alarmed; if placement in such situations has been wrong, suggestions for transfer should be recommended.

III. Misbehavior on the part of women purposely intended to distract men from their work should be watched for. If chronic, the offender should be reported to her foreman and a copy of the report given to Mr. J——— with the counselor's suggestions.

IV. *Every case must be handled individually.* The test of a counselor's personal ability and a final conclusion as to whether the idea of employing counselors is sound, will rest on their ability to keep women doing the necessary work in a cheerful and cooperative manner. Recalcitrants and chronic loafers should be reported to the foreman, to shift superintendents, and to the personnel office with suggestions as to the proper handling of each case.

V. The counselor will make a careful check of all ladies' rooms and shower rooms. All necessary modifications in and additions to any facilities or supplies should be brought to the attention of either Mr. H——— or Mr. G———.

VI. The counselor will be acting in an advisory capacity only. She will work closely with foremen and shift superintendents in solving individual problems, absenteeism, job complaints, requests for transfers, etc. At the same time, she will gain and keep any confidences of the employees. She will do all she can to promote their job satisfaction and well-being. It is hoped that the counselor can help improve personnel relations within the departments. Too often something that might be cleared up in the department becomes a real grievance to the employee for lack of proper attention. It is the counselor's job to try to clear up or prevent difficulties before they become problems. If men come to you for advice and help with family problems, assist them wherever you can. You may help save a valuable employee whom we might otherwise lose.

VII. The counselor must assume the responsibility of determining where a problem should go if she cannot settle it. In all respects, she must temper her judgment with respect to the employees' feelings and wishes as well as to company policies. Her first obligation, of course, is to the company, and in her interpretation of any policy to the employee she can make the employee a more understanding and happy individual if she sees that those policies are clearly stated and understood.

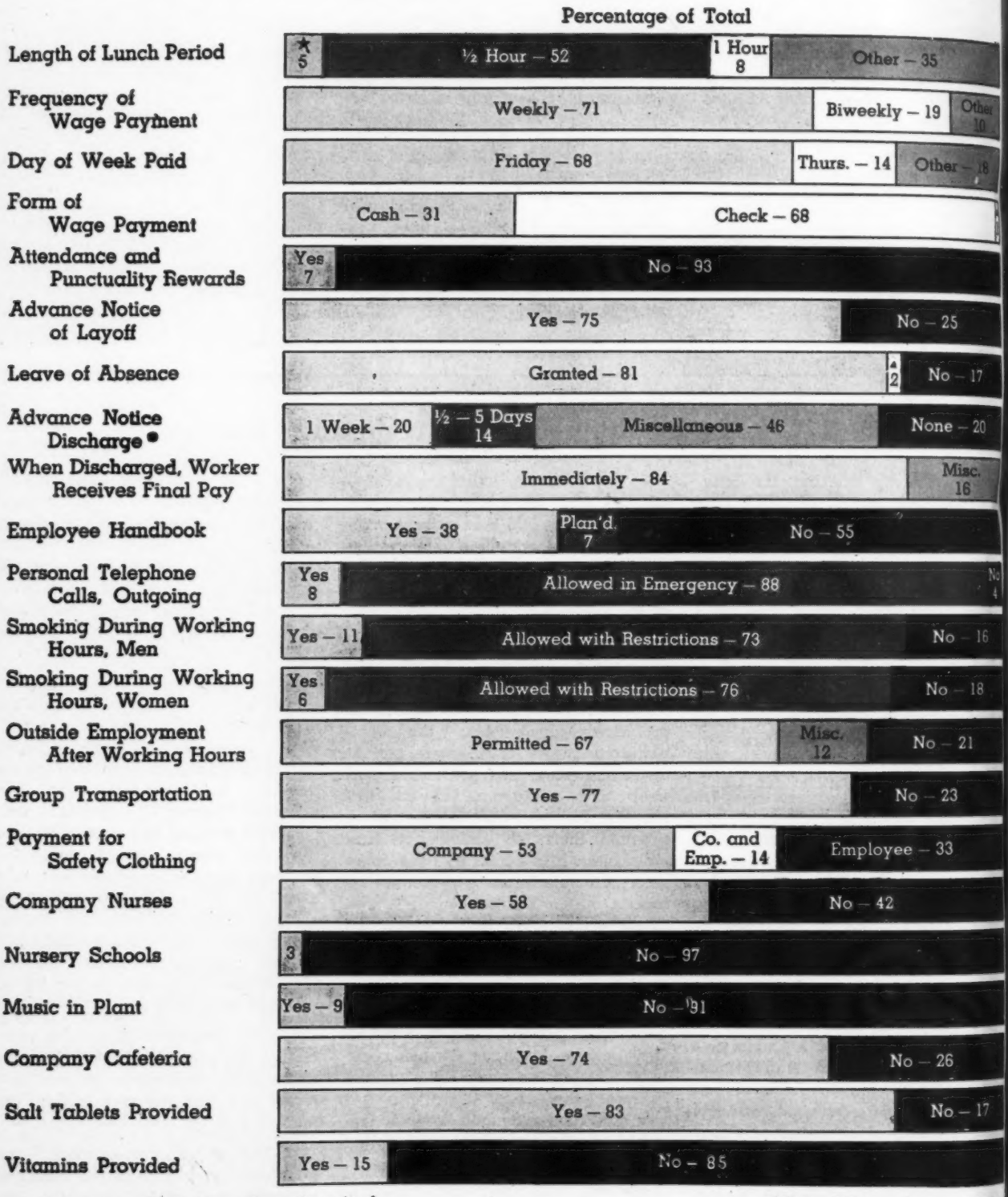
VIII. The counselor must be careful to follow a friendly and judicial attitude, not one of intimacy, which would weaken her position and lower her dignity. She should not promise anything she can't fulfill. Until she becomes thoroughly familiar with company policies, she should reserve decisions where possible until the problem can be discussed with others. Her interest in the employee should encompass home conditions, living conditions, health, recreation—in fact, anything that affects the employee and makes her or him better satisfied with the job.

IX. The counselor should be especially conscious of all safety hazards and unsafe practices for women, and report any that she sees to the foreman and to Mr. H———.

X. The counselor will conduct the new employee through the induction program and check with the employee throughout the ensuing two or three weeks to see that a proper adjustment to the new job has been made.

Guide to Personnel Practices

Questionnaire replies from 1200 plants with 2,500,000 workers indicate degree to which companies are adhering (as of September, 1943) to old and new policies



• For cause beyond employee's control

★Eat while working ▲Other

The above chart is based on a survey made by National Industrial Conference Board, New York, N. Y., and published as one of its "Road Maps of Industry"

MANAGEMENT SHORTS

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary management accomplishments. Accepted articles will be paid for

"Letter Automat" Encourages Messages

SOURCE: Owens-Corning Fiberglas Corporation, Toledo, Ohio

An ingenious home-built device has been developed to increase the flow of letters from members of the Toledo general offices of Owens-Corning Fiberglas Corporation, to former fellow-workers now serving with the armed forces.

The device, familiarly known as the "letter automat," consists of a wooden desk at convenient height for writing, with an opening in the center across which paper is fed from a roll of ordinary teletype paper. Each roll provides for a dozen to more than forty individual messages.

Each day a different service man is designated to receive a letter. The front of a mail box above the desk serves as a bulletin board on which are posted the name and rank of the service man, his photograph, and biographical data including the date he joined Owens-Corning, his position when he left to join the armed forces, and his present address.

As each writer finishes his message he turns a crank at the side of the desk, rolling the written matter onto a roller within the desk, and bringing up a clean section of paper for the next writer. This assures the privacy of all messages. At the end of the day the roll of messages, often a couple of yards in length, is taken from the desk and mailed.

Back from the fighting front, the major uses the "letter automat" to send one of the many messages that will go to a former fellow-worker. Each day a different name is placed on the box, with photograph and present address, to receive "yards" of news and good wishes from his friends.

•

Downtown Clubhouse for Employees

EUGENE A. CONKLIN, Watertown, N. Y.

Porter-Cable Company, Syracuse, N. Y., employees have a clubhouse downtown, where they can drop in to bowl, participate in other sports and recreation, or just sit around and read or chat.

Not all workers want to relax directly after the end of their shift. Sometimes they want to take a guest along. Having their clubhouse downtown in a central location makes it easy to drop in at odd hours.

•

A tray of water in the bottom of this specially designed cigarette-disposal cabinet makes it smokeproof, odorproof, and fireproof. Located at the cafeteria doorways at the Remington Arms Denver Ordnance Plant, it reminds employees to put out cigarettes before entering the factory proper, where smoking is forbidden

•

Departmental Plan for Production Control

J. E. JOHNSON, Foreman, Union Twist Drill Company, Athol, Mass.

The foreman of a department snowed under with war orders found it necessary to adopt a more efficient plan of work dispatching to meet exacting delivery requirements. Several factors had to be recognized in developing this plan for best results: (1) Shop order number, (2) department "due out" date of each order, (3) final shipping date, (4) machines or operators who were to do the work.

A loose-leaf book, each page progressively dated at top, was prepared. If more orders were due out for one day than

Fifteen specially trained "experts" at The Bullard Company, Bridgeport, Conn., are helping company employees fill out this year's complicated income tax return. They work on a half-hour appointment basis and are booked for a week ahead at all times. So far (February 15) they have assisted 1375 employees, expect to fill out 3500 returns

could be entered on any one page, additional pages could be inserted. The routing card which accompanies each order through the plant supplies the shop order number, the department due out date, and the final shipping date.

Upon receipt of each order, the routing card is separated and delivered to a dispatch clerk, who then enters the shop order number and the shipping date in the book on the page that bears the corresponding department due out date. The routing card is then filed according to shipping date.

In planning the next day's work, the clerk removes from the file the routing cards of all orders scheduled to leave the department during the following week. From these cards, a list in duplicate is prepared, giving shop order, number, kind, size, quantity, and date due out of department. Each assistant foreman is given a copy, from which he locates and delivers to machines only the orders that are due to go out. Progress follow-up is provided for by clerk checking at 3-hour intervals.

The best proof of this method of dispatching is that orders, instead of being chronically late, now often leave several days ahead of schedule.

•

Girls at Blackhawk Manufacturing Company, Milwaukee, have formed a "Fe-Mail Club." Each member draws the name of a former employee now in the armed services from a hat—makes it part of her war job to write newsy letters about company doings to the owner of the name she has drawn.

•

Two girl employees of the Taft branch subassembly plant of Lockheed inspected their handiwork during a recent visit of a B-17, just off the final assembly line in Burbank

Subassembly Workers See Finished Product

SOURCE: Lockheed Aircraft Corporation, Burbank, Calif.

Providing outside plant employees of the Lockheed Aircraft Corporation for the first time with a close-up glimpse of how the parts they make operate, a model B-17G bomber, just off the assembly line at Plant 1 in Burbank, recently was taken on a tour of branch subassembly plants, where it was viewed by hundreds of interested workers.

The airplane was used as an inspiring instrument to bring home to these workers a clear understanding of the importance of the work they are doing. A great majority of them had never before seen a B-17 close up, very few of them knew exactly where or how the subassemblies on which they had been working, were used.

When the huge air fortress landed at Hammar Field in Fresno, tags were attached to the parts that had been assembled at the Fresno plant. Shortly after noon a caravan of cars carrying swing shift workers drew up beside the plane and hundreds of swing shifters climbed up specially built platforms allowing them to look through various windows and other openings in the plane and see parts made by themselves. During the following two days workers at plants in Bakersfield and the Taft plant viewed the parts they had made. Taft employees went to work an hour early one morning so they could get off early and see the plane before it had to leave.

It was felt that the plan had so successfully accomplished its morale-building purpose that the Army would arrange to have it repeated by other companies having outside plants.

MAINTENANCE SERVICES

The well-maintained plant is the high-production plant

SELECTION • INSTALLATION • INSPECTION • UPKEEP • ORGANIZATION

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CHANGE OF ADDRESS

McGRAW-HILL PUBLISHING COMPANY
330 West 42nd Street, New York, 18, N. Y.

Director of Circulation:
Change my address on Factory Management and Maintenance

From .....

.....

To .....

.....

Signed .....

FACTORY MANAGEMENT AND MAINTENANCE
McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42nd STREET, NEW YORK 18, N. Y.

MAINTENANCE as the Editors See It

Management Must Help to Conserve Truck Tires

MANAGEMENT of industrial plants that operate highway and intraplant trucks cannot regard tire conservation as something for the other fellow to worry about. With the tire situation what it is, the obligation to see that conservation of these indispensable parts is continuously and vigorously pushed, becomes a matter of inescapable concern.

How to get more miles from automobile and truck tires was explained in a special section in the January issue of FACTORY. A reader who has had wide experience in automotive vehicle operation and maintenance suggests the following four steps that management should, and easily can, take to implement an effective truck tire conservation program:

1. Discuss corrective measures with some local automotive wholesaler who is in position to recommend the proper tools, gages, and equipment for testing and maintaining vehicles.

2. Send the man responsible for vehicle maintenance to the local wholesaler, who can, in turn, direct him to a repair shop that is fully qualified to do corrective work which is beyond the ability of the plant's garage.

3. Make sure that frequent tests are made of such matters as tire inflation, wheel balance, and frame, axle, and front end alignment.

4. Send one or two men responsible for the maintenance of plant vehicles to the local educational meetings being conducted by the ODT.

FACTORY is glad to endorse these steps, in the belief that they can help materially to keep a serious shortage of tires from growing worse.

Don't Get Careless About Fire Prevention

A BIG PLANT, just about two years old, turned into smoking rubbish. Twenty-four engines for Liberty ships destroyed. Costly machine tools, fixtures, and gages reduced to junk. About 1250 workers left jobless, at least temporarily. Around $2,000,000 gone up in smoke. That is the sorry record of what happened recently in a few hours in a West Coast city.

The cause of the fire is not known at the time this is written. So far as that war plant is concerned, it is too late to do anything about the cause, whatever it may have been.

This disaster can well serve, however, as an expensive reminder that fire is by all odds the greatest saboteur of our war program. There have been bad fires in other war plants and there is little reason to hope that this will be the last one.

Fire is a fearfully destructive, ever-present menace that can be controlled only by constant vigilance and the intelligent application of well-known principles of prevention and firefighting. Most fires do not just happen. There are not many serious blazes that could not have been prevented by more careful study of the hazards, installation of the proper safeguards, strict enforcement of safety regulations, all backed up by an adequately trained and equipped crew of firefighters.

Fire prevention is one activity in plant operation in which vigilance cannot be relaxed, even momentarily, without the gravest risk.

Let Equipment Makers Know What You Want

OPERATING EXECUTIVES who have wished that they could help to design some of the equipment which they use, will have that wish gratified, so far as one firm's industrial trucks and tractors are concerned. Clark Tructractor Division of Clark Equipment Company is giving the opportunity, through a questionnaire that is being sent to executives in every industry in which materials handling is a problem.

The reason for enlisting the help of industry in this fashion is based on the conviction of Clark executives that in order to carve out the kind of economic future which we all want, it will be necessary to increase greatly our production of fine-quality goods. They hold that this will require developing a much larger percentage of highly skilled labor, with a consequent decrease in the number of unskilled workers; and that to release unskilled labor for training in the skills required for high-quality mass production, handling of materials must be mechanized still further, and studied as an integral phase of the production planning for the future. But industry must provide the facts as to its requirements which equipment manufacturers need in order to design machinery that will serve with maximum effectiveness.

Surveys without number have been made to determine what the buyers of consumer goods want. Such studies of the needs and desires of the users of industrial equipment have been much less numerous and extensive.

The Clark survey is a commendable procedure that may well be the forerunner of constructive attempts on the part of progressive manufacturers to give industry the best equipment that can be designed. Such efforts to serve industry better deserve the full cooperation of plant executives.

Arc Welding Helps Us Meet Emergencies

In emergencies, or when long delays are met in obtaining equipment that must be had in a hurry, a good welder, some odds and ends of scrap metal, and a little ingenuity can work wonders in producing what is needed to get production going

WALTER J. BROOKING, Director of Testing and Research, R. G. Le Tourneau, Inc., Peoria, Ill.

ANY ORGANIZATION that has the equipment and trained personnel for producing arc-welded products also has the tools for economical production of many items of shop equipment which may be built specifically to its particular needs.

Our company uses the arc-welding process extensively. The ability to make many of our shop fixtures by welding has been of great help in emergencies as well as when obtaining standard equipment was difficult or subject to long delays, as during the past couple of years.

Storage Equipment

These fixtures include racks and equipment used for the storage of parts or raw material, such as the buggies, tote bins, skids, or carts, that are used for the handling or transportation of parts; specialized jigs and fixtures used in making products of the plant; special modifications made to adapt standard machine tools, motors, hoists, and other standardized factory equipment to specific production needs, and even, at times, the manufacture of specialized machines for large-volume mass production.

A reasonably skilled maintenance welder can produce in steel the same kinds of fixtures and equipment that would be produced by a skilled carpenter or cabinet maker, in wood.

Arc welding is peculiarly adapted to the production of fixtures because a large variety of shapes, sizes, thicknesses, and forms of commercial steel may be cut, stamped, shaped, premachined, and placed together to form the functional parts of the device, whether it be a conveying unit, a motor bracket, a machine base, or a transportation buggy. They may be fused together by welding so that the joints are as strong as the parent metal; and usually with such rigidity that special lap plates, or heavy bracing, need not be incorporated into the design.

Figure 1. Steel rack made of angles put together to form box sections

Such structures are commonly characterized by great strength and ruggedness, and the ability to absorb the type of abuse and extremes of service that are common in the handling of the steel parts found in plants manufacturing welded equipment.

One of the important factors in the manufacture of arc-welded products is the efficient use of material. And, since in almost any arc-welding operation there are end cuts of bar stock or segments of plates left over after the salable product of the organization has been cut from them, it is frequently possible for many of the shop fixtures to be built from material that is a byproduct of the shop's major production items, and which would otherwise be sold for scrap.

For example, the steel rack shown in Figure 1 is made up of 4x4x¼-in. box sections formed of two angles welded together. It is 11 feet high,

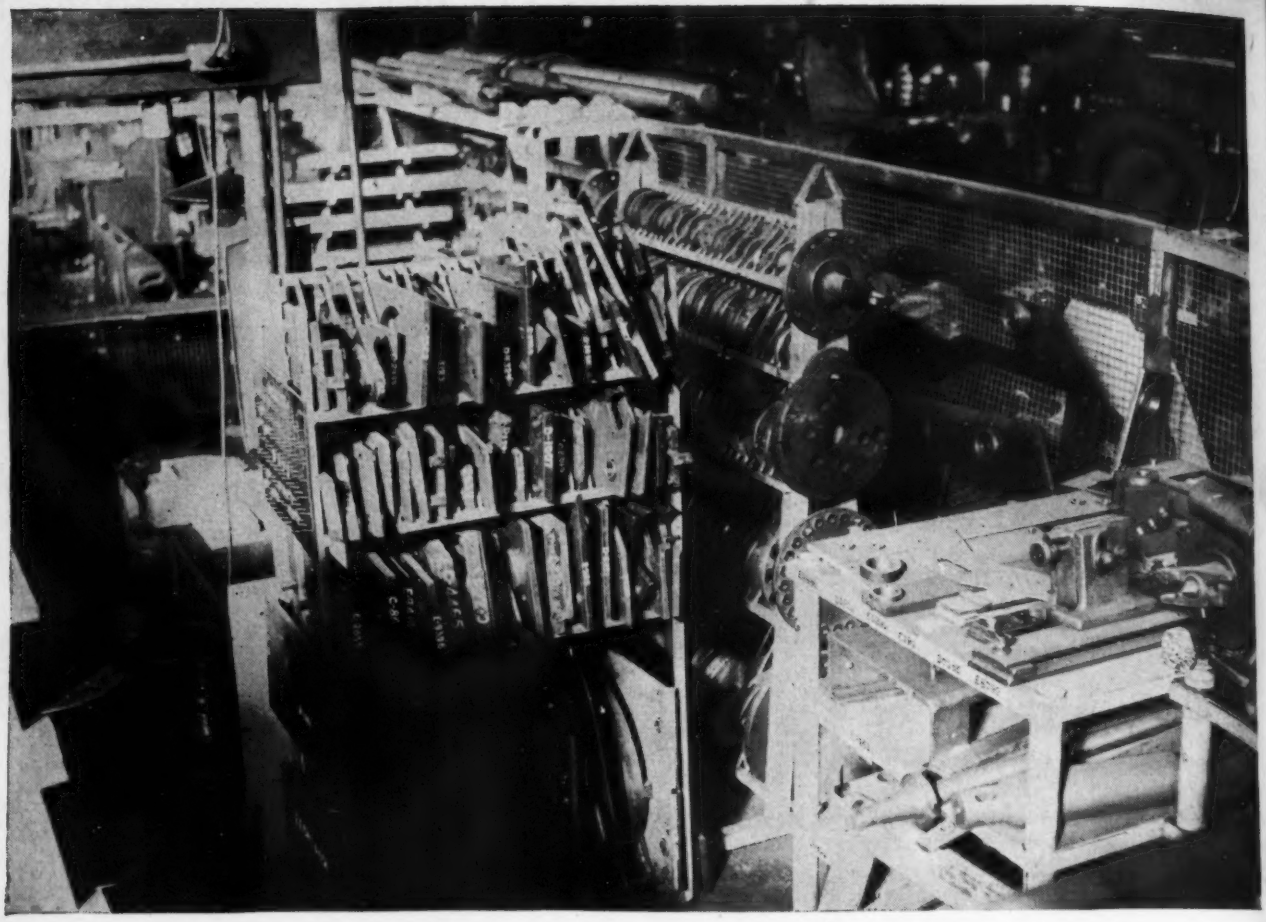


Figure 2. These racks make it possible to store jigs and other parts handily and in minimum space

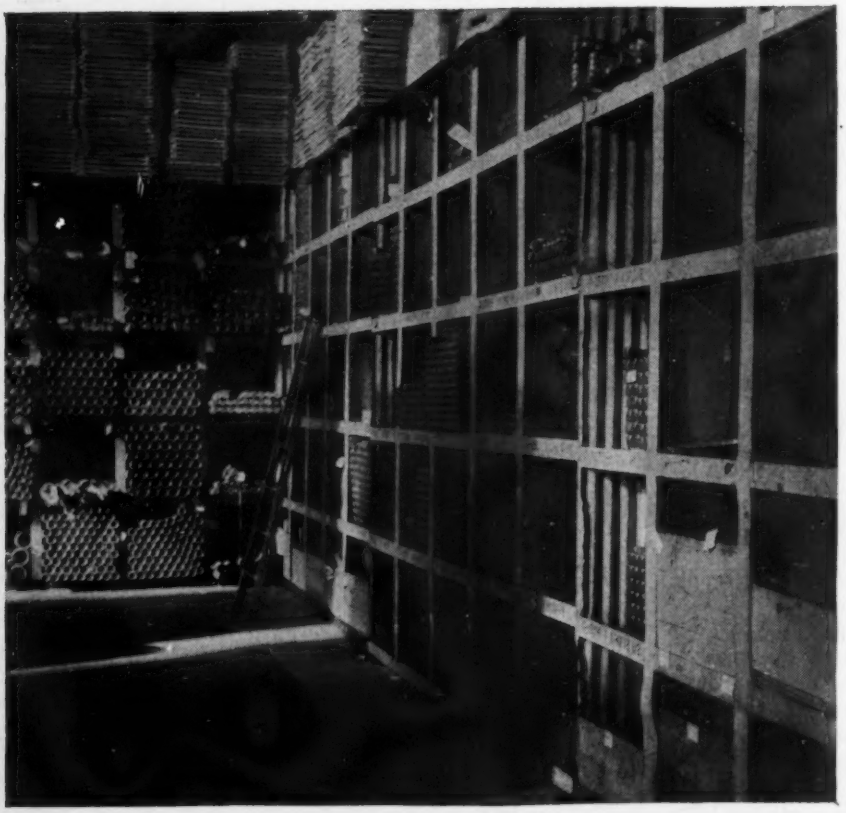


Figure 3. Bins made of light-gage metal form the walls of a storeroom

28 feet long, and more than 24 feet wide.

By removing the 1¼-in. square cross-pieces, which are inserted into holes in the side of the upright section, this rack may be entirely loaded by an overhead crane. Or, if sufficient stock is to be removed at one time to justify the move, it may be unloaded the same way.

This rack is only one of a large variety of similar racks used in the storage of other types of steel, rough bar stock, raw materials, and cut structural parts, on the fabrication department floor and in other areas of the plant.

A common storage problem in flame-cutting departments and machine toolrooms is that of storing production templets, dies, jigs, and fixtures, in an orderly manner which is also economical of space.

Racks for Drill Jigs

The racks shown in Figure 2, for the storage of drill jigs in the toolroom of a large machine shop, and the adjacent rack for the storage of more bulky fixtures, embody many desirable characteristics of such a storage rack.

Figure 4. Welded tote bins and skids facilitate storage of parts and stock, and handling by lift truck

The problem of storing parts in the most readily accessible type of bin, and yet in the smallest space required, is a major consideration in parts storage or warehousing.

For Finished Parts

The all-welded steel bins shown in Figure 3 are installed in a corner of a central warehouse for the storage of finished welded parts or assembly parts. These bins are composed of several standardized stock bins which, when placed together, form the walls of the storeroom as well as the means of storing a large quantity of parts in a small area.

This rack is made in sections five compartments high and five long, each compartment capable of holding approximately 2½ tons of solid parts.

The compartments are made of light-gage metal reinforced by somewhat heavier strips, which form the lower lip of the storage compartment, and also help to reinforce the structure.

Modifications of such an arc-welded bin, using various sizes and numbers of compartments, answer a large variety of needs in the manufacturing and storage departments. They are easy to make, relatively inexpensive, and definitely economical from the space standpoint.

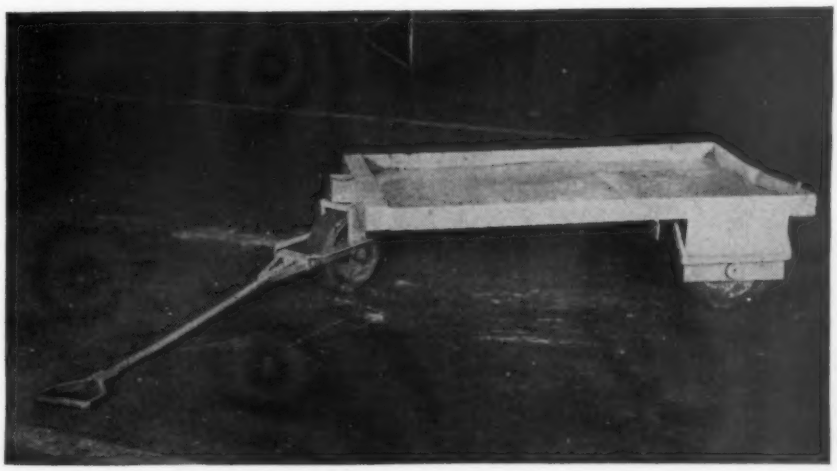
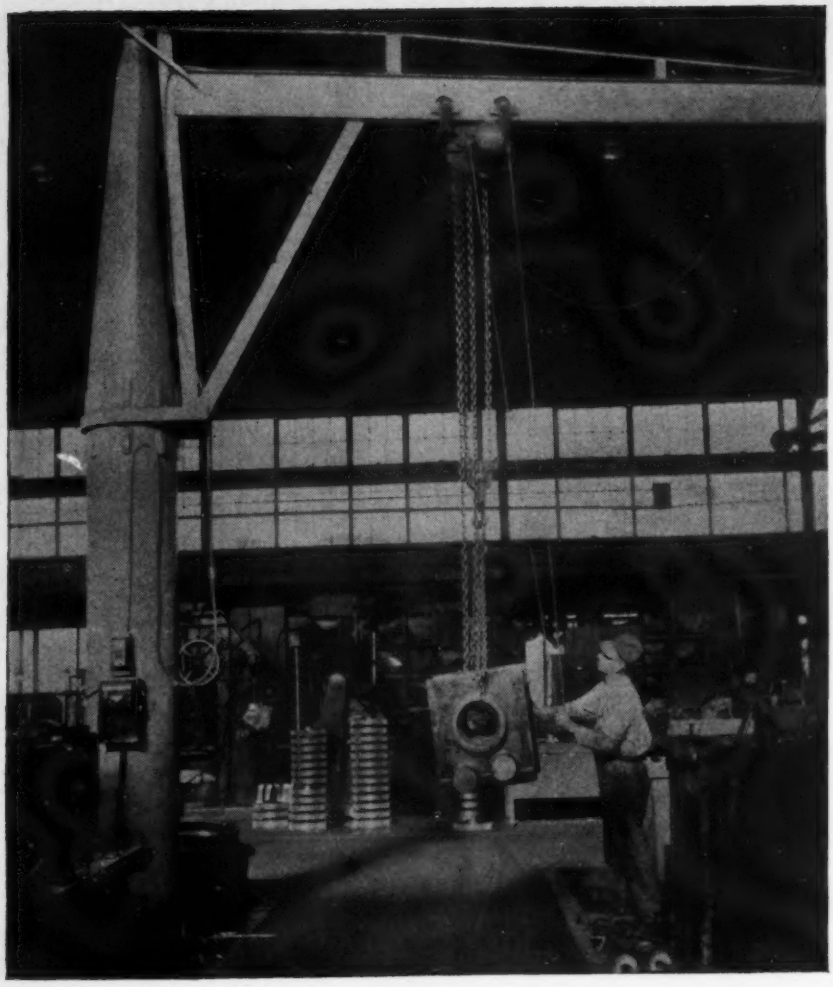


Figure 5. Out of odds and ends of scrap metal comes a sturdy little buggy that can be used in handling equipment and stock in the shop

Figure 4 shows two standardized types of materials hauling and temporary storage bins and skids, made by arc welding, which are effectively serving their purpose.

These bins and skids are capable of handling approximately 4000 pounds of solid steel parts, although frequently the skids have a much lighter load because of the skeleton-like forms of many parts, or the number of parts that are being handled per order. Note tote bin No. 125, in the center of Figure 4. It is contructed of 14-gage material, reinforced with channels across the bottom, under which the lift truck's forks may be



thrust for lifting. On the channels around the top there are loops by which the unit may be handled by the overhead crane. The bin rests on box section legs which nest, so that bins may be piled as high as convenient or necessary.

The skids are made of ⅜-in. bottom plates with panel reinforcements about the sides, and standard-height legs with caps on the bottoms, so that the skids may be stacked into piles.

A Sturdy Buggy

For handling equipment and stock within the shop, a number of standard small hand buggies, such as shown in Figure 5, were made, using angles, pipe, small lengths of bar stock, and a section of plate for the bottom. Some of the parts were end cuts that normally would have been considered scrap. The simple, three-wheel design facilitates easy handling, and the arc-welded construction gives rigidity, ruggedness, and relatively light weight. For heavy transportation these buggies may be loaded with as much as two or three tons of stock and pulled by hand, lift truck, or tractor.

Figure 6. This welded crane serves an area 52 feet in diameter

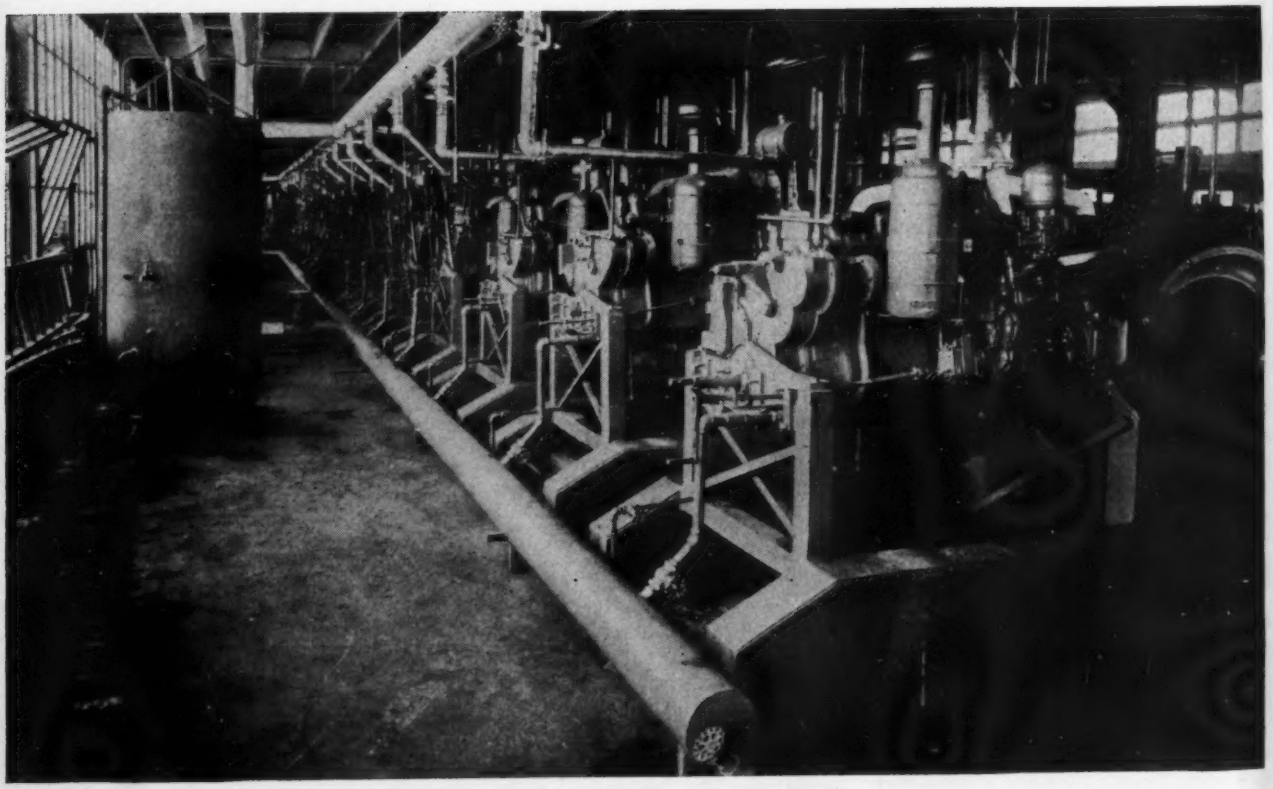


Figure 7. Engine bases, made of box sections and plates welded together, were built one or two at a time as they were needed. Major box members at the bottom were filled with concrete for stability

Reference Dept.

This buggy represents one of the standardized units for hauling within the shop, but at least three other types of arc-welded buggies of larger size or specialized shape were made for certain specialized jobs where there was enough hauling to justify making a specialized unit.

Another major portion of the handling equipment of this large shop is a series of overhead cranes combined with stationary jig cranes, which provide overhead service to all parts of the shop where heavy lifting must be done.

The arc-welded jib crane shown in Figure 6 has a lifting capacity of 4½ tons and serves a floor space 52 feet in diameter.

Plenty of Room

The overhead crane above it clears it only by about 5 inches, yet the boom construction of the crane itself, plus the hoist, occupies less than 3 feet, so that the maximum working space is available under the boom.

Arc-welded construction, with its rigidity and skeleton-like design, makes possible this effective use of space by

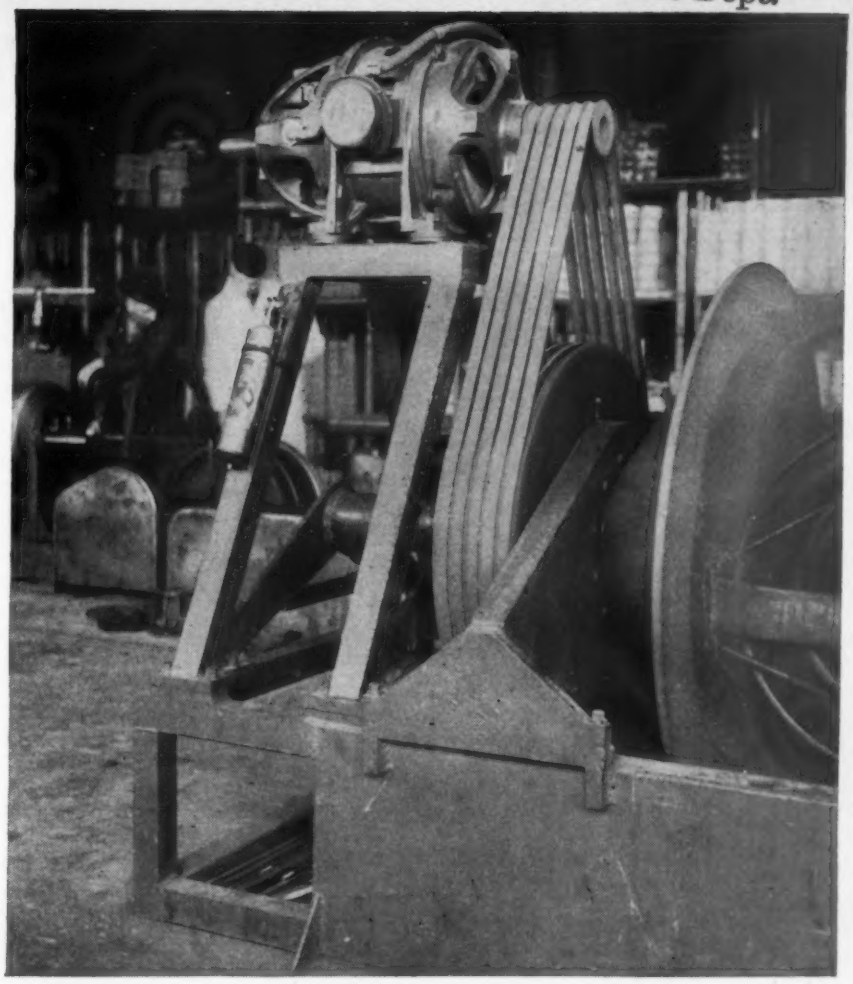


Figure 8. Scrap box sections and plate make a neat motor mounting

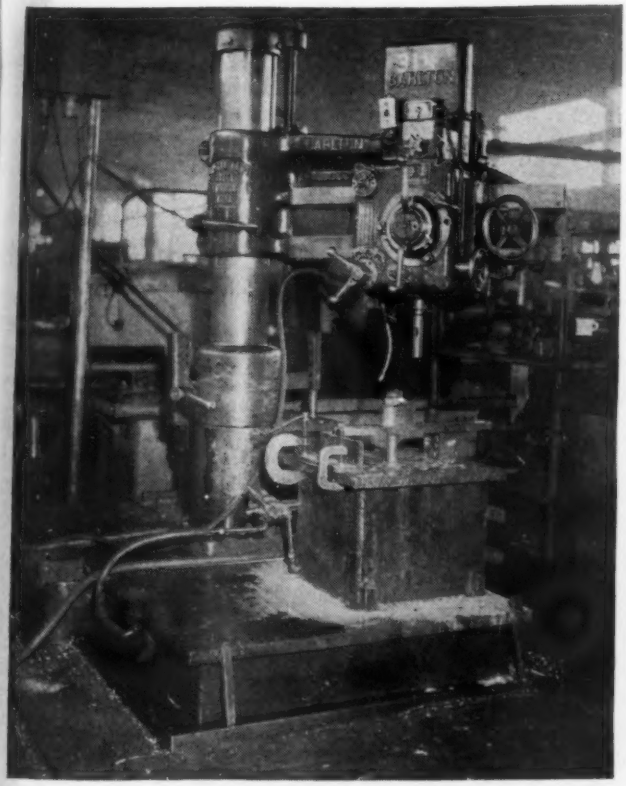


Figure 9. A special base for a radial drill, easily fabricated by welding, practically doubles its output

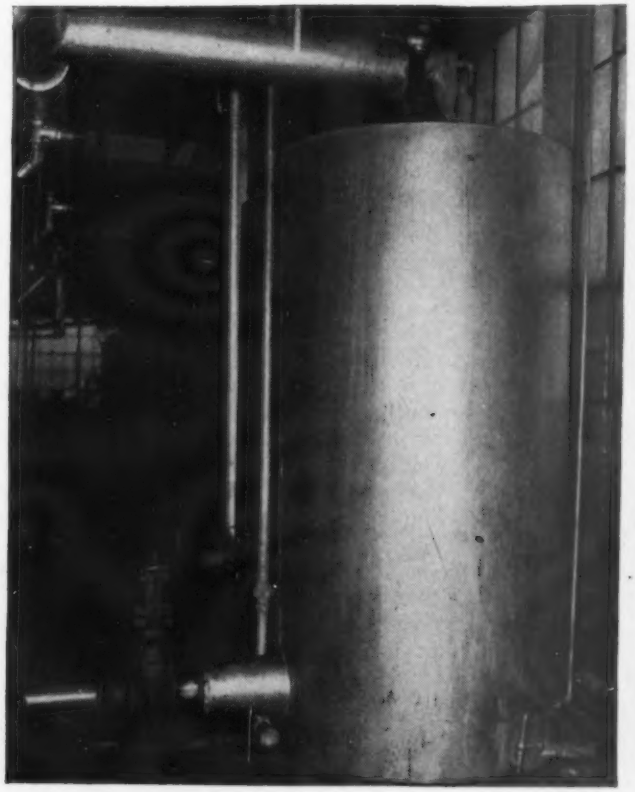


Figure 10. Welded tanks and pipelines handle cooling water for the engines in the power house

Fig. 11. A forging furnace was needed in a hurry. So plates, box beams, channels were welded together to answer the specific need

limiting the structural members of the crane itself to a small area which lies just below the overhead crane. At the same time there is maximum working height under the boom.

The traveling crane above it is a 10-ton job, with a 96-ft. span. Its depth is only that of the main I-beam members, so that the total clearance between the top of the jib crane and the rafters is less than 5 feet.

Engine Bases

A part of the first cost of an engine or a power machine almost always includes some adaptation of that unit by means of a base or a mounting fixture so that the unit can perform the specific function for which it was purchased.

The bases shown in Figure 7 are examples of one of the many methods of mounting motors or power units. These engine bases, made of box sections and plates welded together, were built one or two at a time as they were required during the growth of the power plant.

The large, major box members at the bottom of the base were filled with concrete to give weight to the base and stability to the assembly. Shapes and structural members found in the shop were used to build them. Bolt blocks and bearing seats were cut from bar stock and machined prior to being welded into these bases. They might equally as well have been made from I-beam sections, channel sections, H-, Z-, or T-beams, if these had been standard materials in the shop and available.

A similar construction for mounting an electric motor is shown in Figure 8, where a skeleton-like bracket was made for the main motor of an all-welded wire rope closing machine.

This bracket again exemplifies the ease with which a skeleton-like framework may be bolted on a small footing on the framework of the machine itself. In this instance, too, small, pre-machined bolt blocks permitted the base and bracket to be installed without machining the entire structure after it had been welded together.

It is frequently good economy to mount certain types of machine tools, such as the radial drill shown in Figure 9, on a specialized base to permit more efficient use of the machine.

Double Duty

In this instance a simple steel base was constructed of a relatively light bottom plate, a 1-in. top plate, spaced apart by box-like side plates and center web plates (to keep the base from buckling), followed by the construction of a very light pan around the base for coolant and mounting a coolant pump. The base provides two drilling stations over specialized all-welded steel layout and hold-down plate structures, one of which may be used while the operator is laying out work and getting ready to use the other.

This arrangement allows the drill to be used a larger percentage of the time than it could be if it were confined to a small, single-station bed and one operator.

The hold-down table mounted on top of the base is a relatively simple arc-welded structure, containing an air vise that facilitates holding down parts quickly and positively.

The effectiveness with which arc welding may be used to make storage tanks specifically adapted to the needs of the plant, is illustrated by the tank and piping system shown in Figure 10. This application is part of the cooling and circulating system for the motors in the power plant shown in Figure 7.

Tight Joints

The liquid-tight and gas-tight welded joints in this piping system are distinctly advantageous. And the elasticity and simplicity of construction put such work well within the reach of the average maintenance welder who is capable of making or understanding simple layouts, flame-cutting parts to the layout, setting up the parts, and welding them together. Almost any shape of piping system may be made, in order to clear structural members of buildings, or to adapt the system to certain specialized requirements.

Another example of the construction of specific shop equipment is illustrated in Figure 11, which shows an all-welded forging furnace constructed to the size, heat capacity, and other specialized features dictated by certain needs.

The structural body of the furnace was made of plates, box beams, channels, or I-beams (whichever lent themselves best to the design or were available), which produce a relatively light but very strong shell of the proper size and correct form for the purpose. After the shell had been welded together, and the fixtures for actuating the doors by air were placed on the frame, the unit was lined with refractories, connected to the fuel line, and, after burning in, was ready for its specific services.

It is a specialized unit, built simply and inexpensively, in a minimum length of time, to do a specific job.

This furnace is only one of more than half a dozen different types of furnaces used in one organization, each of which is built for a special purpose. Standard furnaces could have been purchased which would serve each of these various functions; but they would not be specifically adapted to the need. They would represent compromise as to form, size, space, or function, and the delay in securing them would have been serious.

Training Maintenance Men

L. H. GRUTSCH, Works Manager, The Cleveland Tractor Company, Cleveland

When the number of our employees increased 500 percent in the short period of three months, our maintenance problems increased at an even greater rate. Experienced maintenance workers were almost non-existent, therefore we instituted a training and placement procedure to help fill the gaps in our maintenance force.

When a new maintenance man is to be hired, the master mechanic interviews the candidate before he is assigned to the maintenance group in which he is to start. These new employees range from youngsters with absolutely no experience to older men with a large amount of knowledge and experience, most of which usually does not apply to our specific needs.

To explain our placement and training procedure, let us follow a new man, Joe for convenience, through the various steps of becoming a good maintenance employee.

Joe has applied to the personnel department for a job. The interviewer finds him husky, intelligent, alert, and with an apparent keenness of mind. He is considered to be capable of learning the maintenance job specified on the requisition. So Joe is sent to the master mechanic for assignment.

Here the interview discloses the fact that Joe has an interest in things electrical. Therefore he is placed with the foreman of the lighting section, which is one of five sections of the electrical maintenance division. He is started here in a beginner's job, because he has had little experience. We want him to become familiar with electrical maintenance equipment.

★ The well-maintained plant is the high-production plant

Joe works with the foreman of that section and is encouraged to absorb all the information he can. He is watched by the foreman and the master mechanic for his aptitude, interests, and abilities.

Usually within a few days he receives his first 110-volt shock. If he shows signs of fear, or nervous reaction, he is promptly transferred out of the electrical group and into one in which electricity has no part. If his reaction to this shock is in the nature of de-

Step 1. Repairing lights, under supervision of electrical foreman

Step 2. Testing electrical equipment for shorts and grounds

veloping a respect for electricity, and he exhibits no fear, he stays in the electrical division. The foreman gives him all the information he can, and tells him what books will be of help. He is encouraged to go to night school.

We find that Joe is a good man, and he is soon transferred to the construction section, where he goes through much the same process as in the lighting group. Here his aptitude for troubleshooting verifies the finding in the lighting section, and Joe is transferred to the troubleshooting section. Here, again, the process is similar, and he progresses steadily.

We need troubleshooters; so we give him extra training and extra coaching on troubleshooting. He works with 220-volt circuits for a time, and we watch the care he takes to avoid contact with live equipment. We are particularly interested in his reactions in case of shock, and in his watchfulness for the safety of others. As he shows ability and skill on the 220-volt circuits, we assign him to 440-volt work, and still maintain our coaching and observation. Joe's judgment and willingness to call for help when he gets in beyond his experience soon enable him to go out alone on troubleshooting assignments. Hence, Joe becomes a full-fledged general troubleshooter.

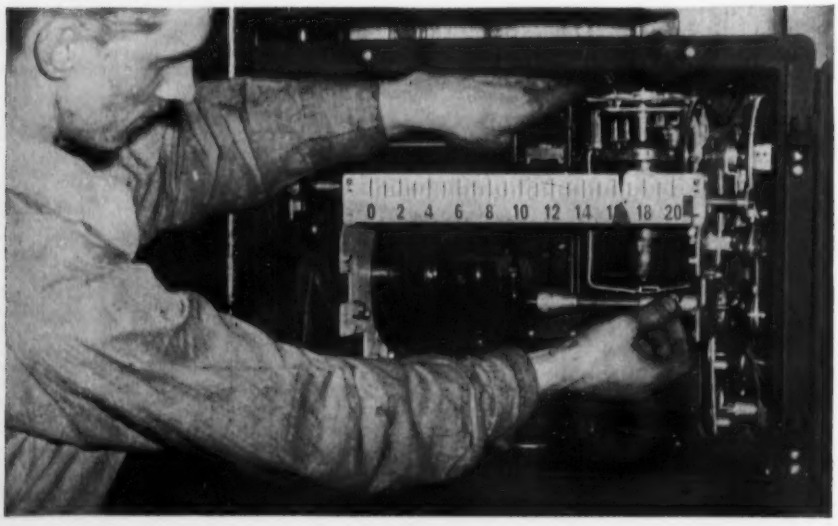
We may soon need a troubleshooter in the electrical furnace gang. So we examine the records of all the troubleshooters, and find that Joe shows the greatest aptitude of any of the men for this work. We call him in, talk it over with him, and if he still appears to be a good choice, we assign him to the furnace crew.

But let us backtrack a bit. Getting and training a new maintenance man is not always so easy. For example, we hire a man for the electrical department and find that he is afraid of electricity. We try him out in the carpentry department on building repairs and find he also has an abnormal fear of heights.

He seems to be a good mechanic, however, so we try him as a millwright assigned to floor work. He proves excellent in this work, is coached by his foreman, and urged to study. Perhaps he is not outstanding, but he does a good job and winds up with a permanent assignment.

We have employed a number of older men in the maintenance division and find that many of them develop into excellent workers. They usually have good judgment and the ability to learn when carefully and properly coached. We use the greatest possible care to place older men in work with which they are familiar. This step makes these men more content with their jobs and more keenly interested in working at top efficiency. Of course, they all need some specific training, which we endeavor to give them. On the other hand, occasionally we find a man who refuses even to attempt to learn new things. Such a man is seldom likely to develop into a satisfactory maintenance employee, except on the labor gang.

Step 3. Repairing heating elements on 220-volt electric furnace



Step 4. Checking temperature of heat-treat furnace control equipment

Eleven Possibilities

We have eleven classifications of maintenance work to which electricians, carpenters, millwrights, and plumbers may be assigned. Most of our new men are readily fitted into one of these classifications. The master mechanic spends about one-third of his time observing the maintenance men at their jobs and making notes as to their qualifications. In this way he is better able to fit these men to the right jobs.

This close, careful watching has taken a man from a ditch-digging job and made him an oiler and then a belt man. It has also located some misfits and aided in placing them in jobs within their capabilities and interests. We feel that this activity of the master mechanic is most essential in making best use of available men.

Our selection, training, coaching, and assignment of maintenance workers, hurried though it had to be, has produced excellent results in keeping our plant up to production schedules. The continuous observation of all maintenance employees under varying conditions has also served to keep the department at as near top efficiency as possible.

Use the Proper Heater in Overload Relays

R. B. TAYLOR, Industrial Control Engineering Division, General Electric Co., Schenectady

MOST MODERN MOTOR STARTERS include thermal overload relays to protect motors against damage from excessive heating as the result of an overload. An overload is commonly considered to be any abnormal condition resulting in a current not exceeding the stalled rotor current for a.c. motors, or not more than four times full-load current for a d.c. motor.

The majority of thermal overload relays have a renewable heater of resistance material through which the motor current flows. In the event of an overload of sufficient magnitude and duration to injure the motor, the heat generated in the heater is utilized to open the relay contacts by one of several methods. The most common methods are:

1. Melting of a low-temperature solder.

2. Deflection of a bimetallic element, which may be in the form of a straight strip, a disk, or a helix. Figure 1 shows a typical small relay of the bimetal type.

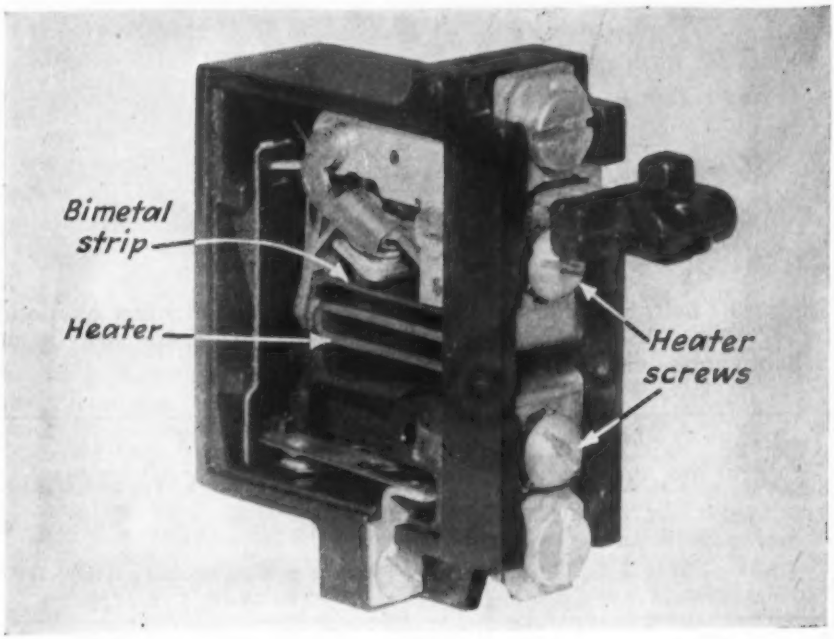


Figure 1. Typical overload relay of the bimetal type. Deflection of bimetal strip under the influence of heat opens relay contacts

Heated by Induction

Another type is the induction temperature relay. This relay has a series coil surrounding the thermal element, which is, in effect, the secondary of a transformer. The thermal element may be a copper tube enclosing a bimetallic strip (Figure 2) or a bimetallic helix (Figure 3), with the ends short-circuited by a flexible copper connection. The relay shown in Figure 3 has the additional feature of ambient compensation, as the result of which the tripping is substantially independent of variations in ambient temperature at the relay location.

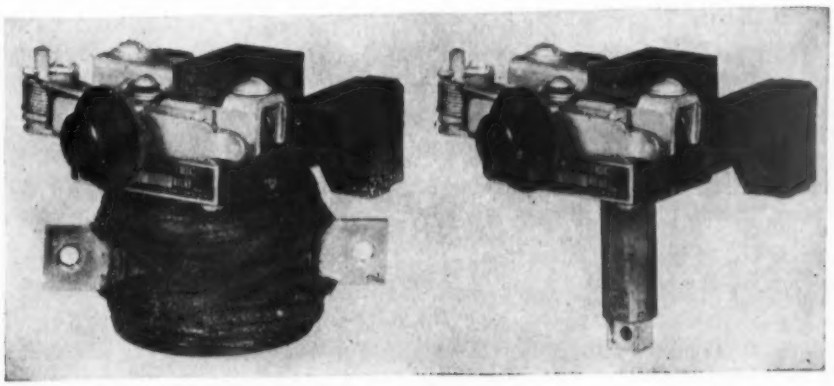


Figure 2. In this induction temperature relay, the thermal element is a copper tube that encloses the bimetallic strip

Formerly, for a calculated load of 7½ horsepower, the machine designer would play safe and specify a 10-hp. 40-deg. C. rise motor that was guaranteed by the manufacturer to deliver 115 percent or 11½ horsepower continuously. Under such conditions, injurious overloads were uncommon. Today, under WPB regulations, the machinery manufacturer must take advantage of the service factor of the motor in order to conserve critical materials. Therefore a standard 10-hp. motor may be used for loads up to 125 percent or 12½ horsepower.

As a consequence, motors on newly installed machines are being operated at much higher temperatures, and it now becomes of vital importance that they be protected against abnormal load conditions that will produce excessive motor temperatures. Selection of the proper sizes of heaters for overload relays is necessary, not only to give the motor proper protection, but also to prevent undesired tripping under the increased motor loads now permitted.

Makers of temperature overload relays and controllers using such relays usually supply a list of heaters with

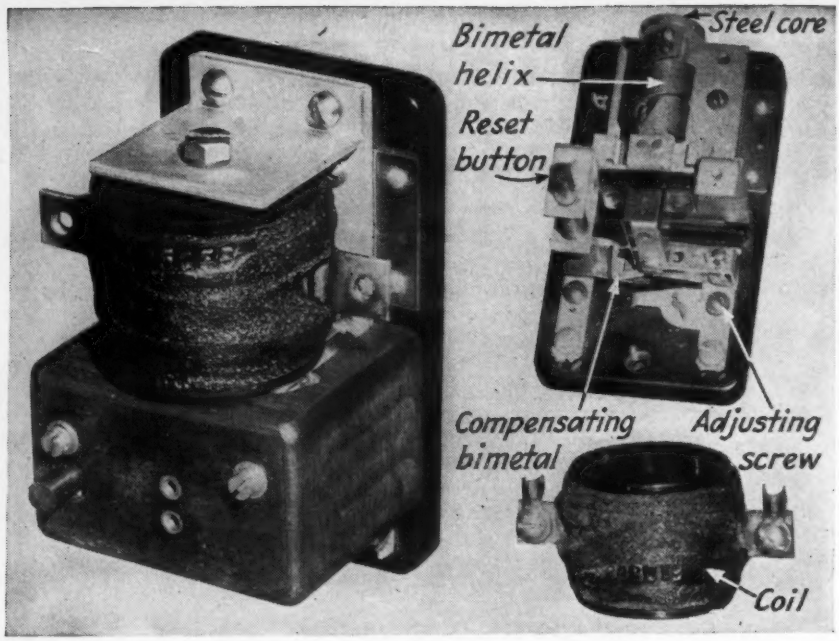


Figure 3. Left, an ambient-compensated thermal induction overload relay. Right, disassembled view of relay. The bimetal strip is of helical shape, with the ends short-circuited

FACTORS TO APPLY WHEN SELECTING OVERLOAD RELAY HEATERS

Motor Type	Motor Load	Use of Manufacturer's Heater Table for 40-deg. C. Rise Motors
A.c. open type, 40-deg. C. rise, continuous	Not over 115 percent,	Use heater table as published
	*116 to 125 percent	Add 10 percent to motor amperes and use table as published
D.c. open type, 40-deg. C. rise, continuous	*Not over 115 percent	Use heater table as published
A.c. or d.c., 50 or 55-deg. C. rise, cont.	Not over 100 percent	Multiply motor amperes by 0.9 and use table as published
	*101–110 percent	Use heater table as published
A.c. or d.c., 50 or 55-deg. C. rise, 1 hr.	Intermittent	Multiply motor amperes by 0.8 and use heater table as published
A.c. or d.c., 50 or 55-deg. C., 30 min.	Intermittent	Multiply motor amperes by 0.75 and use heater table as published
A.c. or d.c., 50 or 55-deg. C., 15 min.	Intermittent	Multiply motor amperes by 0.7 and use heater table as published

*Indicates overload advocated under War Production Board Conservation Order L-221, "where the motor rated voltage will be maintained and the ambient temperature normally will be below 40 deg. C. and will only occasionally and for short periods equal or exceed 40 deg. C."

the recommended range of motor full-load current for each heater. Such data usually result in the selection of heaters that will trip ultimately in a 40 deg. C. ambient on about 115 or 120 percent of motor full-load current. Where motors now are being used on loads up to 125 percent, it is obvious that some changes are in order in the method of selecting heaters.

The table will aid in the correct selection of overload relay heaters for motors applied either as in the past or in accordance with WPB Order L-221 of December 2, 1942. While the heater tables of various manufacturers vary slightly in the ratio of heater current to motor full-load current, the recommendations in the table will be generally satisfactory.

For intermittent-rated motors these recommendations should be considered as approximate, since the correct size of heater will vary somewhat with the application and the type of duty cycle.

Thermal overload relays should not ordinarily require any maintenance other than occasional inspection. See that the relay is kept reasonably clean and that the heater screws are tight (Figure 4). When mounting heaters, particularly those in which small wire or thin material is used, care must be taken not to distort the heater when tightening the mounting screws.

In relays of the renewable-heater variety, there should usually be a small air clearance between the heater and the heat-responsive element. In some instances it is desirable to position the heater properly in order to provide such clearance while the heater screws are tightened.

Never attempt to change the calibration of an overload relay by bending the bimetallic element or other parts of the relay, since this treatment is almost certain to destroy the calibration, or interfere with the proper operation of the relay mechanism. With most relays the calibration should be changed only by substituting a heater or coil of a different rating, although some relays are designed to provide a small amount of adjustment of the tripping current.

Check by Tripping

If the relay mechanism is readily accessible, the mechanical condition of the tripping mechanism may be checked occasionally (Figure 5), by *carefully* tripping the relay, manually. With relays of the bimetal type, tripping can usually be accomplished by deflecting the thermal element *just enough to cause the relay contacts to open*. Make sure that excessive force is not applied, since it may change the relay calibration.

Relays of the melting-alloy type can ordinarily be tripped manually by releasing the latch engaging the ratchet wheel on the thermal element. Manual tripping should be done only by experienced persons.

One of the most frequent causes of premature tripping, or of failure to trip on overload, is incorrect selection of the heater or coil. If relay performance appears to be abnormal, always make sure that the proper heater or coil has been selected.

When an overload relay trips out,

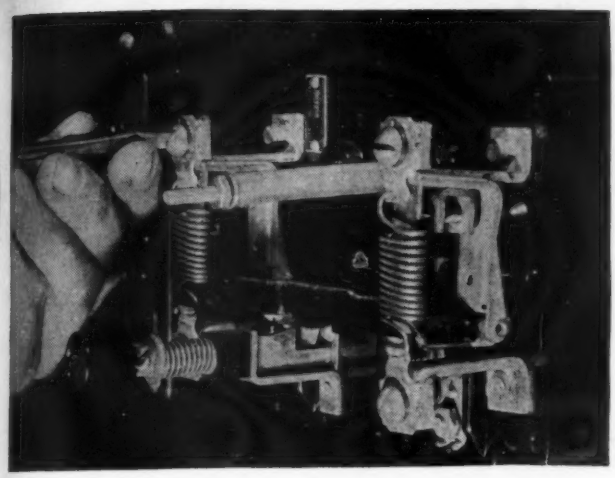


Figure 4. When installing heaters it is important to make sure that mounting screws are tight

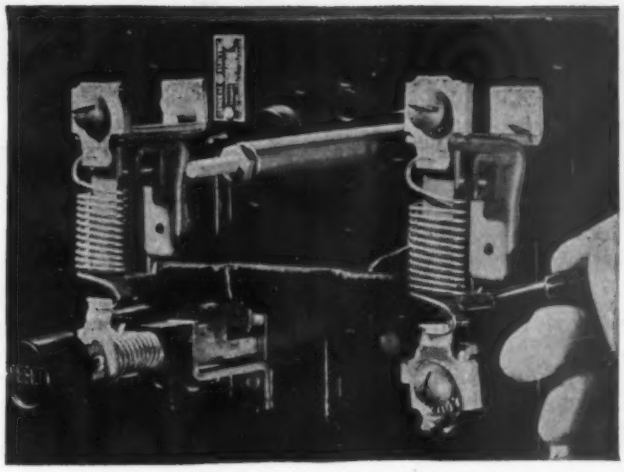


Figure 5. Occasional manual tripping of overload relays makes a good check on their condition

investigate the following possible causes of abnormal motor current, in addition to the obvious procedure of examining the motor for evidence of higher than normal temperature:

1. Stalling of the motor, due to either excessive load or single-phasing of the polyphase power supply.
2. Abnormally high load. Check the motor current and compare with the full-load current given on the nameplate.
3. Excessively low line voltage. Lower than normal line voltage results in proportionately higher motor current for the same load.

Unusual operating conditions, such as abnormally high ambient temperatures, are sometimes responsible for the tripping of overload relays. Standard motors and controls are designed for operation in a 40-deg. C. ambient. It should be kept in mind that ambient temperatures in excess of 40 deg. C. may produce excessive motor temperatures and will cause most overload relays (not ambient compensated) to trip on a lower value of current.

If the ambient temperature is unusually high at the point where the control is located, but is normal at the motor, a slightly larger heater or coil may be used. With most overload relays, the current at which the relay will trip is lowered by about 8 percent for every 10-deg. C. increase in ambient temperature. A simple rule that is ordinarily sufficiently accurate calls for the use of a heater or coil one size larger if the maximum ambient at the control exceeds the normal 40 deg. C. maximum by 10 or 15 deg. C.

With relays having ambient compensation it is not necessary to use a larger heater or coil for unusually high ambient temperatures, since the reduction in tripping current will not usually exceed 3 percent for each 10-deg. C. increase in ambient temperature above 40 deg. C. Such relays may ordinarily be used in ambient temperatures up to 60 deg. C. It must be remembered, however, that if the motor ambient exceeds 40 deg. C. the life of the insulation will probably be shortened appreciably unless the load is reduced or the motor is specially designed for use in the ambient temperature encountered.

Checking Calibration

Usually it is not advisable to attempt to check the calibration of thermal overload relays in the field because of the special equipment and technique needed to get accurate results.

The manufacturer's check of the calibration is made by either a current or a temperature method, depending on the design and construction, and the accuracy required. When the temperature method is used, either the entire relay or the thermal element is immersed in a bath of oil or water maintained at a constant temperature. Since the temperature at which the thermal element trips may be anywhere between 85 and 150 deg. C., depending on the relay design, it is evident that a temperature check cannot be made in the field without knowing the nominal tripping temperature of the particular type of relay being used. It is also to be remembered that certain types of relays may be damaged by immersion in water or oil. Furthermore, the temperature method of calibration is, in general, not applicable to ambient-compensated relays. For these reasons it is usually inadvisable for the user to attempt to check the tripping temperature.

Fortunately, serious errors in relay calibration are quite rare except where the relay has been tampered with. In such a case either the complete relay should be replaced or a new thermal element put in if the relay is of the type in which a readily renewable element is employed.

IF YOUR COPY OF *FACTORY* IS LATE—

Be patient, please. The nation's transportation system is severely loaded. The delay may be unavoidable. Allow a few extra days before writing us. Both the publisher and Uncle Sam are doing everything they can to get your *Factory* to you on time

Saving Materials and Time Through Sound Salvaging

"EVERYTHING IS SALVAGED but the hot air." That is what they say at the Crane Company's Chicago plant. Most of the salvage processes can be used by any industrial plant. Others are more or less specialized and applicable only to a large plant of the same general character.

Crane is especially proud of its success in salvaging tungsten carbide tool tips. Approximately 1500 pieces of this hard material are used each week, and about 10 percent of these pieces are salvaged from tips that have become too small for a specific job, or have been broken. All such tips are removed from the tools and placed in boxes, according to size and grade. When a tool requiring a new tip comes to the toolroom, an effort is made to obtain the needed piece from this salvage stock. These pieces are ground to fit the tool and brazed in place, after which they are ground to the correct cutting edge. Many of the tips wind up as the points of scratch awls. It is important, of course, to keep all grades of this hard-cutting material separate, since they are used for a wide variety of purposes.

This campaign has been so effective that the superintendent of the tool and pattern room had occasion to chuckle when word of WPB's suggestions for salvaging tungsten carbide were relayed to him. He called the toolroom and had them bring over a box that contained all the odds and ends that had accumulated over the past three years. The collection weighed all of 2 pounds.

Everything Saved

The use of hard-surfacing materials is carried into the repair of parts such as shafts, shoes on sand mixers, and other equipment subjected to severe wear. Worn shafts are built up with hard-surfacing material and ground to size. Standard bearings are kept in use and it is unnecessary to carry so many sizes in stock. Most of the hard-surfacing material used in the foregoing salvage operations is reclaimed from various processes in the plant.

Pattern equipment for products such as Crane makes, gets hard usage—especially the equipment used on items made in large quantities. Even in normal times it is expensive and time-consuming to make new patterns. The situation is worse today, because it takes materials that are essential and tends to slow up production.

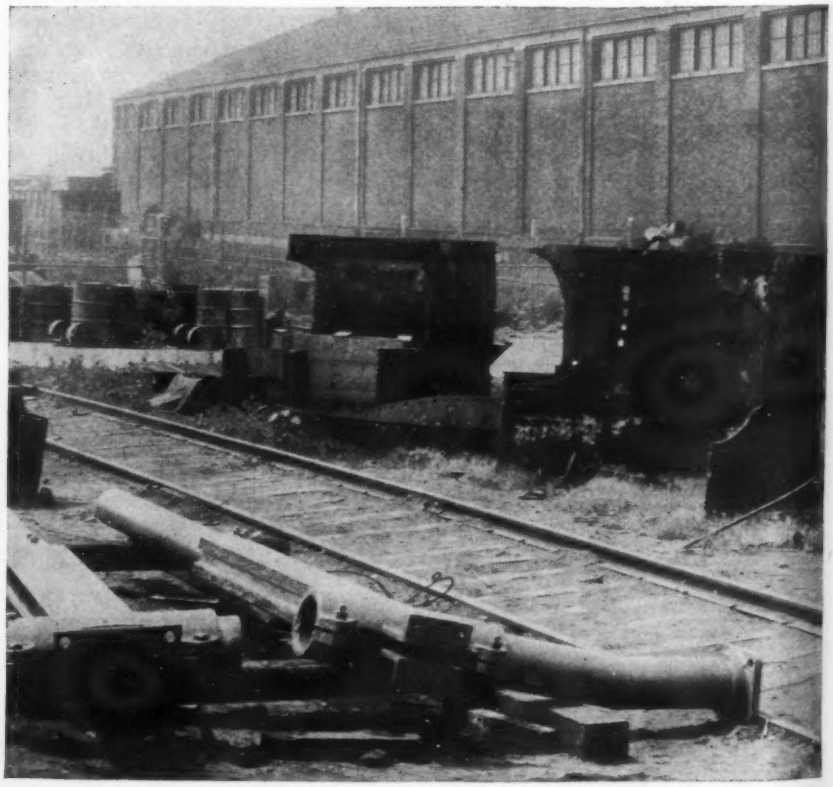
Some time ago, therefore, Crane investigated the possibility of adding to the life of pattern equipment, and found that metallizing made it possible to extend the service life far beyond the normal life.

Similarly, on wood patterns, plastic coatings offered the same opportunities. As a result, the shop is using both methods to add years to pattern life, is thus able to reduce the man-hours needed to make new patterns, and, not to be overlooked, it is also effecting economies in manufacture.

When, recently, the need for an additional electric furnace arose, and deliveries were scheduled for many, many months in advance, an old electric furnace was garnered from the scrap pile. The base, rockers, rocker gears, columns, and other miscellaneous parts were in usable condition. The maintenance shop made most of the parts that were missing or damaged, and a new jacket was riveted and welded together. It was necessary to purchase only some gears, motors, and control equipment. Thus a unit equivalent to a new furnace was ready for operation in about six weeks. It made more than 18,000,000 pounds of steel castings during the time it would have taken for a new furnace to be delivered.

Shavings and chips from machines are, of course, kept separate and are handled by the clean-up men for sale to scrap dealers or for re-use in the foundry. For example, Crane uses large amounts of cast and forged steel and in a single 24-hour period may salvage as much as 65 tons of steel turnings, from which, incidentally, 800 gallons of oil will be reclaimed.

Iron turnings were formerly charged



No chance of getting a new electric furnace for months and months, so Crane Company went to its own scrap pile and found the "makings"

loose into the cupolas—but it was found that about 40 percent of the material was lost in the process. A briquetting machine was then installed, and the loss now is less than 10 percent.

The brass foundry, however, presents a unique problem in materials salvage. Here there is much slag, ash, spill, and miscellaneous scrap from the melting pots, ladles, and molds. Much of this material is collected from the molding sand by the shakers and screens. All sand is continually re-used. Spills and slag are thrown into the shaker and move with the residue from them to a primary sorting table, where all large pieces of metal are removed. Care is taken here to remove as much iron as can be found. All the material that passes from the primary sorting position is sent through a ball mill that reduces the sand, ash, slag, and metal to relatively fine particles. Included in the material sent to the ball mill is dust collected from the floor by vacuum cleaners and brooms. This dust has been screened before entering the mill. After the material passes through the ball mill it goes to a vibrating table where the brass particles are washed out. All metallic deposits from the concentrating table go through a gas-heated dryer that removes all trace of water, and the dried material is then sent to a magnetic separator which removes iron or steel particles. The salvage process is continuous and nearly automatic. The brass from the major foundry is sent back to the smelters for re-use. However, certain parts of the foundry use special alloys, and these materials are kept separate and sent through the ball mill and vibrating table at different times. The alloys are re-used in the furnaces because it is possible to maintain a constant accurate check of the alloy.

The value of this reclaiming procedure becomes apparent when 7000 pounds of brass are salvaged every 24 hours. These 7000 pounds do not include gates, poor castings, and other large pieces which are picked up from the foundry floors.

Diamond saws are quite widely used in this plant. Diamond dust from these saws is salvaged by burning out the plastic material from which the disks are made. It is necessary to free the diamond dust from all other residue. The dust is then used for special lapping and other grinding and polishing operations.

Files have always been one of the chief "tool headaches." All means of sharpening and reconditioning have been tried. Now all files are annealed, recut, and rehardened. Although this treatment makes the files a little smaller, it does make them readily available, at a much lower cost than new ones.

Foundry equipment is subject to severe wear and requires extensive maintenance. Old rubber belting is re-used by lining sandblast cabinets with it. Linings made of these rubber belts last for long periods of time, are economical because they use scrap material, and greatly reduce cabinet maintenance.

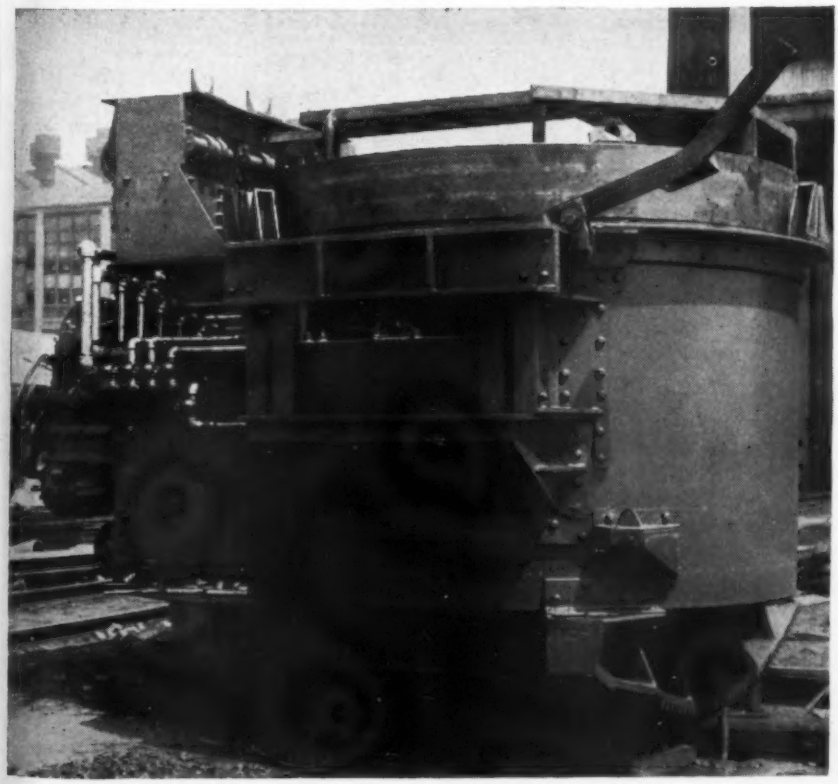
The wear of sandblast hoses has been lessened by providing every possible means to prevent mechanical damage. Use of special heavily covered hoses has more than doubled their useful life. Here the use of special equipment is actually a salvage step.

In the Foundries

Changes in the roller conveyors in the foundries have made possible the salvaging of an unknown quantity of rollers and bearings. Molten metal spills frequently froze rollers to the supports or destroyed the bearing. Cup-shaped washers on the ends of the rollers protect the bearings, and slotted side frames permit easy removal. Now when a roller is damaged, it can be quickly replaced by a good one, and sent to the shop for repairs.

The salvage job in the boiler room has been most successful in the face of war shortages. The boilers were originally provided with chain grate stokers, but the grates were removed, the bottoms bricked up, and oil burners installed. Later, natural gas burners were placed in the opposite ends, and the boilers could be used with either oil or gas. When the fuel shortage threatened, the continued use of oil and gas became doubtful. Fortunately, the old stokers and chain grates had been kept and they were brought forth from the storage pile, serviced, and re-installed, one at a time. By the simple expedient of keeping a layer of coal on the grates, oil or gas can be burned when it is available, and coal can always be burned. Thus both the boilers and the grates were salvaged for use through these critical times.

Although production has increased many times over to meet wartime demands, no new plants were built. The expansion program was met principally by the more careful use of existing floor space—and without disrupting normal good housekeeping practices. This has been accomplished by removal of stock bins, by roofing over courts between buildings, and by the re-arrangement of machinery.



Built from scrap, furnace made more than 18,000,000 pounds of steel castings in the time it would have taken to get a new one

Relays Prevent Line Surges From Welder Operation

G. L. BAUGHMAN, Electrical Engineer, The American Welding & Manufacturing Company, Warren, Ohio

WHEN IT BECAME NECESSARY to add six 750-kva. single-phase resistance butt welders, the increased load created a real problem for both the power company and ourselves. The installation simultaneously of a very large single-phase welder in another plant in the immediate neighborhood complicated matters still further, and led to an extensive exploration of ways to avoid line surges of sufficient magnitude to interfere with the operation of motors and other electrical equipment in our own or nearby plants.

Our first proposal was to install three single-phase, 1500-kva. transformers, 23,000 to 440 volts, with both primaries and secondaries connected in delta. The six new welders, plus four others totaling 800 kva. that had been installed previously, were to be connected single-phase across the three legs of the three-phase, 440-volt distribution lines, balancing the loads as nearly as possible.

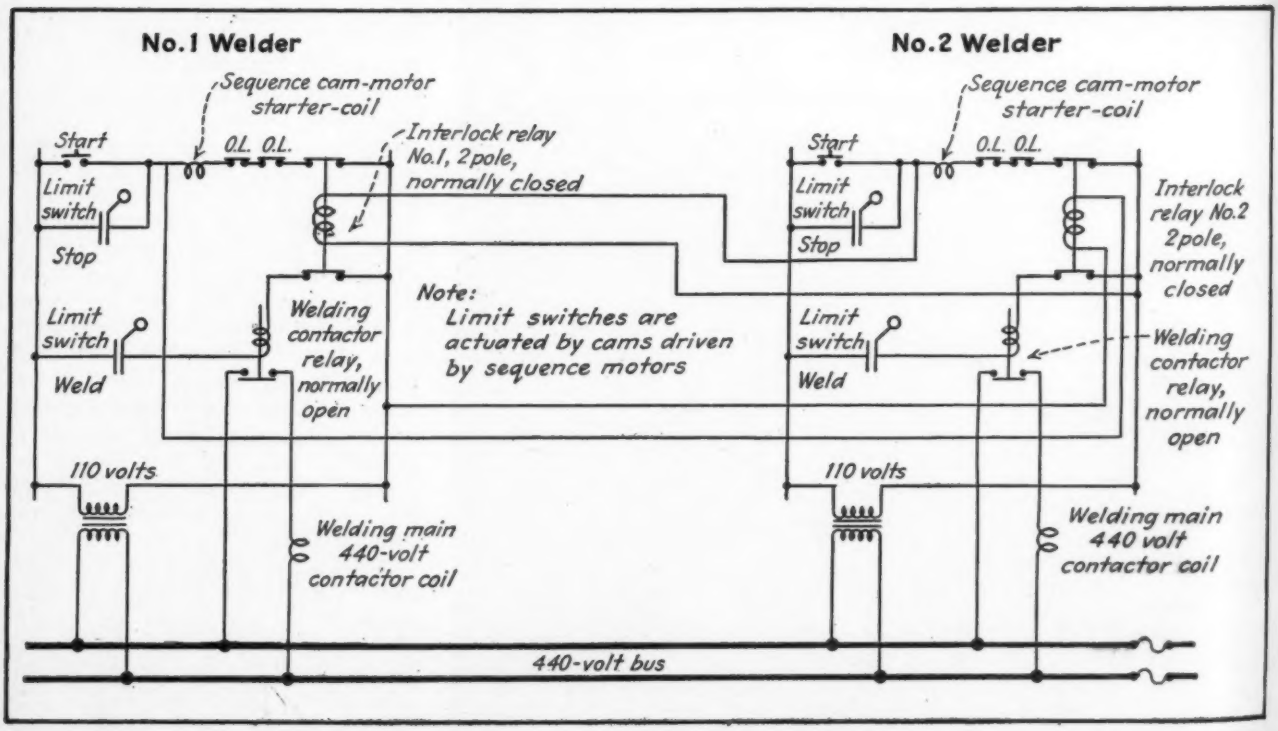
This arrangement would permit individual welders to be operated without interfering with the operation or timing of other welders. It was realized, of course, that all the welders could be thrown on the line simultaneously, overloading the transformer bank. Such overloads, however, were not considered likely to be either frequent or prolonged, since the chances of all welders being operated at once were rather remote.

Alternate Suggestion

An alternative proposal was to install two three-phase, 2000-kva. transformers, 23,000 to 440 volts, balancing the welders on the 440-volt, three-phase distribution lines as mentioned before. While this scheme provided less total transformer capacity, it was felt that 4000 kva. would be sufficient and that the transformers could carry some overload safely. Moreover, the difference in cost between this installation and the one first proposed was fairly substantial.

Two drawbacks common to both these proposals were: (1) The large size of the primary and secondary copper cables required; and (2) the likelihood that it would be difficult, if not impossible, to obtain delivery on them in any reasonable length of time.

After an analysis of these two suggestions, power company engineers were of the opinion that the load surges on the distribution lines would in both cases be sufficient to create difficulties in the operation of other electrical equipment in nearby plants. Furthermore, should the load become unbalanced it appeared certain that



Start button is held closed manually until a cam closes the stop limit switch. This limit switch maintains the motor circuit for a complete welding cycle. The relay for operating main welding contactor coil is actuated by the weld limit switch, also operated by the sequence cam motor

A motor-driven cam controls the rate of speed with which the ends of these rings are allowed to approach each other in the welder, are upset, and then welded together at the proper temperature

this condition would cause too much disturbance clear back to the central station. Therefore, they suggested a totally different solution.

It involved installing a three-phase substation, 23,000 to 2300 volts, to provide power to drive a 2300-volt, three-phase synchronous motor which in turn would drive a 440-volt, single-phase generator to supply power for the welders. While the load on the single-phase generator would, of course, be widely fluctuating, this arrangement represented the most satisfactory solution to the power company, because the fluctuations would be balanced over all three phases.

Obviously, this proposal represented a considerable investment in equipment, including rotating units that would require attention and maintenance. A further investigation, particularly of the duty cycles of the welders, was made jointly by the power company and our engineers.

This study led to the conclusion that the actual load on the line normally would be not more than 2000 kva. Under the circumstances it was agreed that this load of 2000 kva. could be satisfactorily handled if reasonably well balanced on the three-phase service, or if properly proportioned on each of the legs of the single-phase service.

Intermittent Loading

Further study of the cable sizes required, taking into consideration past experience, showed that currents much higher than normal cable ratings could be carried without serious heating effect, provided the loading on the cables was intermittent enough to permit short intervals for dissipation of the heat. The saving possible in the cost of copper, plus the difficulty in obtaining heavy copper cable, convinced everyone that the best solution was (1) to install a 2000-kva., three-phase transformer, 23,000 to 440 volts; and (2) to connect two welders to each phase of the transformer secondary with relays designed to permit operation of only one welder at a time on each phase.

Small magnetic relays, costing less than $10 each, were put in the 110-volt pilot control circuits of the welders. By using this scheme, instead of attempting to apply interlocking equipment to the circuits carrying the heavy currents, a small amount of light control wire was the only additional material required over the regular control equipment normally provided with the welders. Since the relays are of midget design, they could be mounted in the control box supplied with each welder, further simplifying installation of the equipment.

To make a good weld requires uniform voltage and amperage. Manual control of a welder makes it possible to lengthen the time of the weld to compensate for low voltage. Our welders, however, have been provided with automatic timing equipment consisting of a motor-driven cam that controls the rate of speed with which the ends of the parts to be welded approach

Automatic timing of these resistance welders makes the maintenance of uniform voltage exceedingly important. Hence the necessity for keeping line surges down to the minimum

each other, are upset, and then welded at fusion temperature. Uniform voltage and amperage become exceedingly important, therefore, with the use of automatic timing for the welding cycle. The current value is approximately 1835 amperes, 440 volts, at the instant of making the upset. Power factor is 55 percent.

The entire cycle, including the closing of the main welding contactor, is controlled and timed by a camshaft driven by a small sequence motor. The relays mentioned before have normally closed contacts. They were installed in the control circuit of the magnetic starter for the sequence motor. Relay contacts, the magnet coil of the starter, and the start pushbutton are wired in series. The relay is located so that the starting pushbutton can energize the starter coil only when the relay contacts are closed in their normal position.

The magnet coils that operate the relays, as shown in the diagram (page 148), are connected in such manner as to energize the relay coil on the opposite welder whenever the sequence motor is energized on the welder being operated. This action automatically holds open the relay contacts on the opposite welder, preventing the energizing of the starter coil of the sequence motor on this welder, and thus keeping it from starting. If one machine is in operation the second machine will not start until the first machine has completed its cycle, even though the operator of the second machine may hold down the start button of the first machine.

No Difficulties

It is estimated that the actual installation cost of the foregoing equipment was approximately $50,000 less than it would have been if a motor-generator had been used. Since the present installation has been in operation, no complaints have been received from the power company and no difficulties have been encountered in our operations in taking care of all power requirements.

From an operating point of view, staggering the operation of the welders has enabled us to hold the peak power demand down to a point considerably below what it would have been if welders had been permitted to operate simultantously on the same phase leg.

While the actual power consumption per unit of material produced has not been cut, the power cost has been substantially lowered because billing is based on maximum demand.

It is reasonable to assume, of course, that more pieces per day could be produced if it were not for the limitation placed on the operation of the welders through interlocking. No perceptible decrease in production has been observed, however.

Incidentally, small-diameter, heavy rings will pull more current in welding than will rings of larger diameter. The reason is that the current drawn by the welder has a choice of two paths through the ring which, when small, permits more current to stray around the circumference than is the case when the path is longer and consequently of higher resistance. Interlocking control is particularly advantageous in this case, because it limits the high current demand when welding small-diameter rings to the maximum that can be drawn by a single welder.

Machine Tools Must Have Good Foundations

JOHN BAYUK, Industrial Engineer, Jenkins Brothers, Bridgeport, Conn.

CONCRETE SLABS of special design have proved to be a satisfactory solution of a troublesome problem. Mounting machine tools on solid foundations and preventing oil seepage through floors have always been problems in multi-storied industrial plants with regular wood or wood block flooring.

The concrete slab described in this article was designed to afford a simple and inexpensive machine tool foundation which could be readily installed and removed in buildings with wood or wood block flooring over a concrete base or structural slab.

When a new four-story concrete building was erected to manufacture medium and large-sized iron and steel valves, the importance of mounting new machine tools on solid foundations, to insure rigidity and level operating beds, was stressed. The whole program called for more emphasis on precision machine work in valve manufacturing, so that mechanically perfect valves could be assembled in quantities to fill vital war orders.

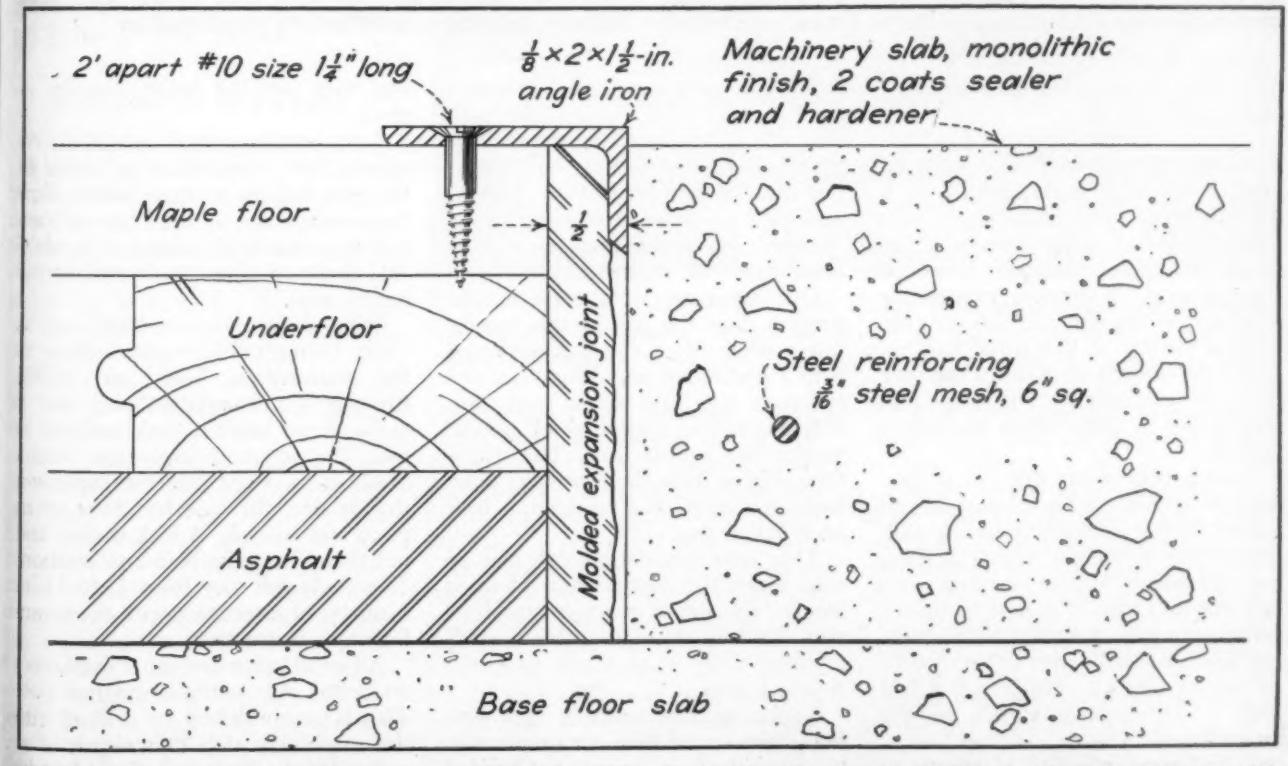
Wood floors cannot provide a rigid foundation for machines. On the other hand, a machine operator finds a wood floor less tiring on his feet after a long day's work.

In our concrete buildings the floors have been constructed as shown at the left in the sketch. As will be seen, a sand and asphalt base 1½ inches thick was laid over the structural slab. It supports the underfloor, consisting of 2x8-in. pine planking. Over it, in turn, was laid a 1x3½-in. face finish maple floor. The maple flooring was sealed with a material whose base is a synthetic resin.

This floor has the characteristics we like, and, in addition, it is sufficiently rugged and waterproof for our purposes. However, such a floor is not well adapted to serve as a foundation for medium and heavy machine tools. Also, it tends to become oil-soaked in time, particularly around screw machines and other equipment that have a tendency to throw out coolant oil or to leak lubricants.

Oil-soaked floors tend to be slippery, and they constitute a fire hazard. Furthermore, we have been bothered by oil soaking in the floor, working through the structural concrete slab to the ceiling below, and then dripping from there to the floor below.

To get around these objections it was decided to mount machine tools, such as lathes, surface grinders, milling machines, medium and large-sized boring mills, and equivalent machinery, on concrete slabs laid over the structural slab. As will be seen at the right in the sketch, these slabs are 4 inches thick and are reinforced with steel mesh 6 inches square, composed of $\frac{3}{16}$-in. diameter wire. These slabs rest directly on the structural slabs, but are not bonded to them. The slabs are given two coats of sealing and



Machine tools are mounted on concrete slabs laid over the structural slab. Although it is better if this is done when the building is erected, slabs can be put in later, by removing part of the floor

Concrete slabs to hold machine tools level and rigid, and to prevent oil leakage to lower floors, and wood floors on which the operator can stand with less fatigue, provide a satisfactory combination

hardening compound to make them oil and coolant resistant.

The slab itself is separated from the surrounding wood floor, or in some instances from the building wall, by a ½-in. molded expansion joint. A ⅛x2x 1½-in. angle-iron strip is screwed to the wood floor and clamped over the molded strip. It serves as a protective strip around the slab and also seals the edge of the slab so that no oil can run under the wood floor in case a machine drops oil excessively. This angle-iron strip is put in place before the slab is poured.

Slabs may be of any size. Some slabs we now have in use are 8 feet wide and extend 90 feet along the building wall. Others are individual islands holding one machine. Where machines are laid out in a row, it is best to have a continuous slab. For instance, we have ten medium-sized turret lathes mounted side by side on a single slab 8 feet wide. The operator stands on the wood floor.

It is somewhat easier, of course, to put the foundation slabs in when the building is being erected, and in a number of instances this procedure was followed. As new machine tools were added, however, and others were moved around from time to time to suit production changes, it became necessary to install new foundations. We found that installing new slabs is easier than one might think.

Our procedure is to mark on the wooden floor the size of the foundation needed. Then the floor is cut out with a portable power-driven saw—an operation that takes only a short time. It is also an easy matter to roll up and remove the asphalt base. The slab is then poured, after the expansion joint, angle-iron edge, and reinforcing have been put in place.

This same foundation slab may be used where the floor consists of wood blocks laid over a concrete structural slab. In fact, it is no problem at all to remove the wood blocks from the required areas.

Replacing these concrete slabs with the original wood floor is a simple matter. Since the foundation is not bonded to the building slab it is an easy matter to remove the slab and angle iron and then set the wood flooring in place.

Some machine tool manufacturers require their machines to be bolted to the foundations, whereas others allow them just to rest on level foundations. For best results all around it is advisable always to adhere to manufacturers' instructions.

When heavy machine tools, such as 60-in. boring mills, require bolting to the foundation, holes are drilled through the foundation slab and 6 inches down into the structural slab to take the required expansion shield. Studs are screwed into the expansion shields after the base has been set in place and leveled. A lock washer and nut then clamp the base into position. The studs will vary from ¾- to 1¼-in. diameter in accordance with the manufacturer's instructions.

All small lathes and other machinery are bolted only to the foundation slab. This is accomplished by drilling into the machinery slab to a depth of 3 inches for the expansion shield to take either a bolt, lag-screw, or stud, whichever is required.

Operating Under Preventive Maintenance

How a specific plant—the Denver Ordnance Plant—organized for preventive maintenance, was told in a February article. We shall now turn to details of operation.

The Denver Ordnance Plant is a government-owned facility supervised by the Army Ordnance Department, and is operated by Remington Arms Company, Inc. Its products are various types of 30-cal. ammunition.

When the plant first opened, the management realized that the several hundred acres of bare ground on which it was situated were going to create a dust hazard. Fine particles of earth and sand drifting into the buildings would injure important dies. The yard maintenance supervisor was therefore instructed to grow a crop of grass in a hurry. Ordinary grass would have required about 18 months to reach a suitable growth. But through the U. S. Department of Agriculture the yard maintenance group obtained seed of a new variety, known as Crested Wheat Grass, that effectively prevented erosion in a fourth of that time. Fast-growing shrubbery and trees were also put in for the same purpose.

Roadways in Repair

Maintenance of tires on motor vehicles operating within the grounds has been aided through complete maintenance of roadways. Every road is patrolled daily, and holes are filled as soon as they occur. Large magnets pulled by vehicles on regular plant business comb the grounds for nails that might injure tires.

Such special jobs are only a small part of the demands on the general maintenance department. Although factory buildings are solidly built, permanent structures, they are not expected to take care of themselves. Every building has a crew of four roving carpenters in addition to the repair and construction crews. These men cruise around in search of minor flaws that might become major ones. A small floor crack or a sagging hinge is discovered promptly and immediately repaired before there is a chance for trouble to develop. Each building also has two painters who look for and perform needed touch-up work. Two pipefitters in each building constantly inspect and repair packings, unions, and pump connections. Three electricians on every shift in each building replace bulbs, check connections, and make whatever minor repairs are needed.

Production people must clean and check their equipment periodically throughout the shift. Every operator is taught enough about his machine to know whether it is operating properly when he goes on shift

Building roofs are inspected weekly for signs of wear or damage that might cause leaks. Each week a certain number of roof drains are cleaned, the entire drain system being covered several times a year. The inspection efforts of these various craftsmen are supplemented by the work of three full-time inspectors who check all buildings on all scores and make daily reports to the crafts supervisor. Under this final check-up procedure, there is very little chance for an unsatisfactory condition to be overlooked.

Because of the vast number of relatively small and intricate machines in use in the production departments, a comprehensive program of preventive maintenance by specialists has proved of tremendous value. As a result of constant adjustment patrolling, a thoroughgoing lubrication routine, and overhaul work on a definite cycle basis, breakdowns have been held to a minimum. Costs likewise are extremely low.

Machine maintenance in each building is directly in charge of an area

STANDARD PRACTICE SHEET

Oiling 1st Draw Presses

DEFINITION:

These 1st draw presses are located in the case area of each of the main manufacturing units. The purpose of this machine is to elongate the case. There are —— of these machines located in each of the main units.

STANDARD TOOLS:

Screwdriver, pliers, oil can, grease gun, rags, 3-ft. stepladder, grease, and oil.

SAFETY PRECAUTIONS:

1. Shut down machine and lock switch before lubricating.
2. Wear goggles when lubricating overhead.
3. Wipe off any excess oil or grease.
4. Wipe up any grease or oil on floor.
5. Make sure that no tools are left on machine before unlocking switch.

STANDARD PROCEDURE:

1. Use oil can to lubricate the 20 oil holes and cups on cams, rollers, and bearings.
2. Use oil can to fill the 2 oil baths on connecting rods.
3. Use grease gun to lubricate fitting on hopper.
4. Use grease gun to lubricate the 12 fittings on main bearings, connecting rods, and feed plates.
5. Report any missing fitting.
6. Report any machine not operating properly.
7. Check all bearings for heat.

A roving painter touches up the worn spots in a red safety line. To stimulate interest in maintaining high standards of housekeeping, a continuous interdepartmental competition is held. Surprise inspections are made by a committee representing all departments

supervisor of the manufacturing building maintenance department, under whom are crews of both routine maintenance men and shop mechanics. Like the roving carpenters, painters, and other craftsmen, the routine maintenance men patrol individual beats, continually inspecting machines and making whatever adjustments may be required. Since there are scores of different types of production machines—20 different types of presses, for instance—each man services only a few types. The number varies according to the machines.

Specialists on Call

Under this plan, the routine maintenance men have become particularly expert and are able to detect a flaw almost instantly. However, additional specialists—one or more for every type of machine—are always on call by either a routine maintenance man or a production foreman. All these routine maintenance men spend their entire time on the production floor; repair shop duties are delegated to still another crew.

The shop men spend their full time in the shops at benches and repair equipment. They work entirely on order, handling special projects and repairs or replacements found necessary by the floating crews. Within the shops the same machinists constantly work at the same machines. Each class of mechanic has a rating according to standards of work and is used accordingly. Jobs requiring the highest de-

There's no "sweeping the dirt under the bed" in this plant. Corners are painted white to encourage thorough cleaning

Standings of the various departments in the housekeeping contest are posted on large display boards in the lobbies of production buildings

grees of precision are always assigned to the best men. The aim all the way through has been to create specialists. Advantages of the plan are obvious.

As was indicated earlier, each manufacturing building has its own machine shop, its own carpenter shop, and various other maintenance machinery. Only enough equipment has been retained in each building to handle all light repairs, and the heavy work is routed to the central shops, where it is handled by the machine overhaul group, which does nothing but major overhaul work. These men tear down the machine, replace parts where necessary, reassemble and readjust it. Where supplementary machine-shop work is required, that work is routed to the area shops under the regular work-order procedure.

Other than emergency repairs, the overhaul crew operates on a definite cycle basis, giving every machine a thorough going-over at intervals that have been recommended by the manufacturer or have proved sound by the Denver plant's own experience. Length of the overhaul periods varies widely because of the many different types of machines in use.

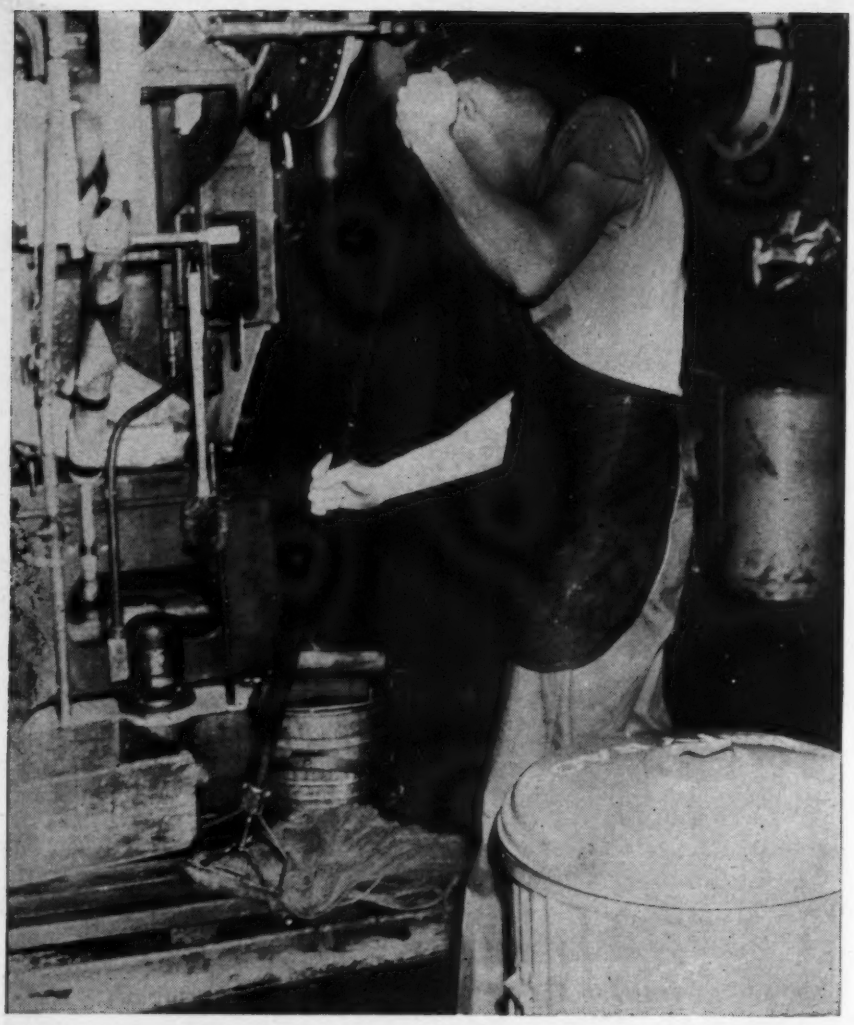
It might be mentioned that while the shops are equipped to make not only parts but also complete machines or anything else required, the Denver plant is cooperating fully in the governmental "small plant" program by sending out whatever can be done on the outside.

The upkeep of maintenance shop equipment, incidentally, is delegated to the shop men. Each man maintains his own equipment except for major overhauls, which again are handled by the overhaul crew.

The aim of the whole machine-maintenance program is to anticipate major difficulties and yet to avoid unnecessary expenditure of labor or wasteful replacement of parts. Overhaul intervals are somewhat greater now than they were on the original schedule. It was found that with constant inspection it is possible to get closer and closer to maximum life of equipment before overhaul. If an occasional machine fails to give full service, its flaws will be detected before a breakdown develops.

Careful attention to lubrication has also figured importantly in obtaining maximum performance. Here again, each building has its own crew of specialists who constantly patrol the machines, oiling wherever frequent lubrication is required. In order that oilers may become expert in handling certain types of machines, the areas are divided up so that each man lubricates machines of just one type and works on the same equipment day after day.

As an aid to efficient lubrication, the Denver plant has produced an elabo-



Wood floors are swept and mopped daily. They are also given a sealing treatment of silicate of soda, which helps to keep down the dust

rate lubrication manual, which contains a detailed standard instruction sheet for each type of machine. A preface to the instruction sheet defines the machine by stating its purpose and giving locations and numbers of units. Where several types of equipment are included in one classification—as in the case of electric motors—full background details are given also. The instruction sheet further covers three "method" points, (1) standard tools required, (2) safety precautions to be taken, and (3) the actual oiling procedure to be followed. Before even an experienced oiler goes on the line, his foreman goes over the machines in detail, amplifying and demonstrating the methods. Each oiler has a copy of the manual for constant reference.

The work done by each oiler is recorded on a specially designed chart, which indicates how many times each machine has been lubricated and what inspections without lubrication have been made. These records not only encourage conscientious effort by the men but also place responsibility.

Because good housekeeping has such an important bearing both on general maintenance and on safety, a strong effort has been made to encourage general interest along this line. Denver Ordnance takes the stand that no matter how large a janitorial force there might be, factory buildings cannot be kept clean without the full cooperation of production employees. This theme is stressed constantly in meetings of foremen and supervisors.

Every operator is taught enough about his machine to know whether it is clean and operating properly at the time he goes on shift.

Regardless of the type of work they are doing, all company employees are held responsible for plant housekeeping. Production people must clean and check their equipment periodically throughout the shift. Shop men and roving craftsmen are commissioned to sweep floors and clean up machines after every job.

To stimulate interest in maintaining high standards of housekeeping, the Denver plant has inaugurated a continuous interdepartmental competition. Surprise inspections are made weekly by a housekeeping committee made up of representatives from all departments. Standings are posted on large display boards in the lobbies of production buildings. As a result of this effort, only one janitor per building is required in the maintenance department. Equal ingenuity has been used to keep the janitorial force on its toes. For instance, floor corners are painted white to encourage thorough cleaning. There is no sweeping the dirt "under the bed" in this plant.

Specialized Duties

Specialized housekeeping duties, such as floor maintenance, are also handled by specialists. The floor crew, for instance, does nothing but this one type of work. In the cartridge loading areas, where powder settlings must not be allowed to accumulate, special employees clean the machines, and even walls and rafters, with a wetting agent every two hours.

Composition floors in the cartridge loading areas—in these buildings static electricity must be grounded to prevent explosion hazards—are treated with a conductive oil once a week, and inspected for efficiency once a month. This type of floor is honeycombed with a network of brass wires. When tests with an electrical instrument reveal that any of these wires are broken, the defective section of the floor must be taken up and the wiring repaired.

Floors in the other factory buildings are of two types—wood block sections and concrete. Because the dust caused by even slight wear of concrete floors would scratch dies and cause wear in moving parts of certain machines, it is most important that dusting of concrete floors is prevented. This is done by sealing with frequent applications of silicate of soda, which was chosen because the surface created is nonslippery. Notwithstanding continual sweeping and daily mopping of the wood floors, they are also given a similar sealing treatment.

It takes well over 1000 men to carry out the preventive maintenance program of the Denver Ordnance plant. But when the consideration of preventive maintenance enters into the original building plans, as it did here, the job of keeping production facilities at peak efficiency is thereby given an invaluable impetus toward its successful accomplishment.

★ The well-maintained plant is the high-production plant

EXIDE-IRONCLADS MEAN EXTRA EFFICIENCY IN MATERIALS-HANDLING

Fast-moving, battery-powered electric trucks are speeding up loading, unloading and load-shifting throughout industry . . . with less waste of manpower. They also are speeding production by permitting women to handle jobs heretofore considered too heavy. In this efficient, stream-lined system of materials-handling, Exide-Ironclad Batteries are widely recognized as a source of never-failing power . . . extra efficiency for an already highly efficient operation. Exides have long been known for their dependability, long-life, and ease of maintenance. The steps you take to modernize with Exides mean economies that are yours for years to come. When you buy an Exide, you *Buy to Last*. Take care of it and *Save to Win*.

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EXIDE-IRONCLAD BATTERIES OFFER THREE VITAL POINTS OF SUPERIORITY

MORE POWER, MORE PRODUCTION: An Exide-Ironclad delivers its power at uniform voltage to assure constant hauling speeds. There is always a giant surge in reserve when an Exide powers your battery propelled vehicles.

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EASY MAINTENANCE, SAVES LABOR: Exides are kept charged by the simplest method ever devised. With the Exide Charge Control Unit all you do is connect battery to the charging source and turn a knob.

THESE RULES PROMOTE GREATER BATTERY EFFICIENCY:

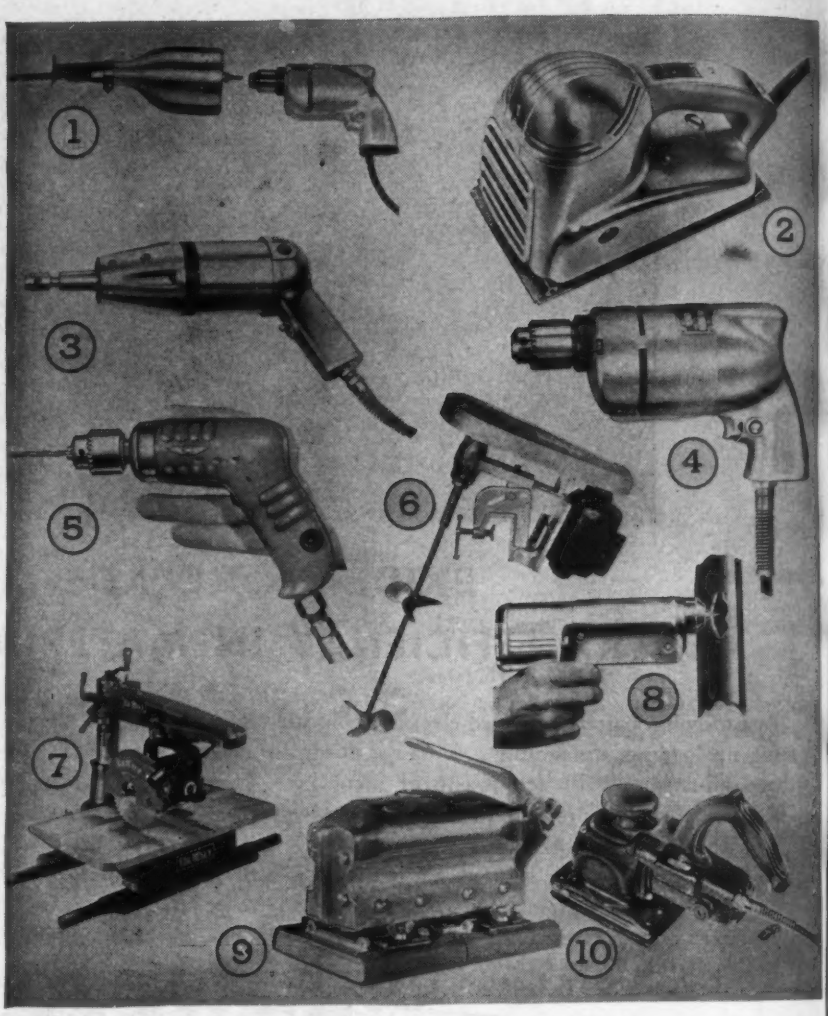
1. Keep adding approved water at regular intervals. Most local water is safe. Ask us if yours is safe.
2. Keep the top of the battery and battery container clean and dry at all times. This will assure maximum protection of the inner parts.
3. Keep the battery fully charged—but avoid excessive over-charge. A storage battery will last longer when charged at its proper voltage.
4. Record water additions, voltage, and gravity readings. Don't trust your memory. Write down a complete record of your battery's life history. Compare readings.

If you wish more detailed information, or have a special battery maintenance problem, don't hesitate to write to Exide. We want you to get the long-life built into every Exide Battery. Ask for booklet Form 1982.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

Portable Power Tools

The portable power tools introduced to you by *Factory* during the past 12 months are reviewed here to give you a quick one-year summary



ATTACHMENT—for drill will saw or file plastics and heavy sheet metal, and will cut directly into wood or plastic without drilling hole for starter. Recommended for use on drill with speed of 2000 r.p.m. or more, the Saw-Gun is said to be easily attached. Mid-States Equipment Company, Saw-Gun Division, Chicago. (Figure 1)

ELECTRIC DRILL—is plastic-encased and is claimed to have power, strength, and protection from shock. Available in 2500, 3750, or 5000 r.p.m. Weight is 3 pounds, 3 ounces; length, $8\frac{3}{16}$ inches; and heavy-duty drilling capacity, $\frac{1}{4}$ inch. Independent Pneumatic Tool Company, Chicago.

ELECTRIC SANDER—Sterling 1000 electric oscillating sanding machines are powered by a $\frac{1}{3}$-hp. universal motor. Detachable sanding pad is held by latch-type lock, takes $\frac{1}{2}$ sheet of standard abrasives, and is flexible. Sterling Tool Products Company, Chicago. (Figure 2)

ELECTRIC TOOL—with push-and-pull action is for use in filing, polishing, scraping, sawing, and sanding. Made with a $\frac{3}{8}$-in. or a $\frac{1}{8}$-in. stroke. Rate of stroke is 1000 to 1200 per minute. Power of stroke is a 30- to 40-lb. push or pull. H. & H. Research Company, Detroit. (Figure 3)

HEAVY-DUTY DRILL—Model 47 Skildrill handles drills up to $\frac{1}{4}$ inch in steel and $\frac{1}{2}$ inch in wood. Drill weighs $3\frac{1}{2}$ pounds, is $7\frac{1}{4}$ by $2\frac{5}{16}$ inches. A two-pole momentary contact switch locks for continuous operation. Available in 1800, 2500, 3500, or 5000 r.p.m. Skilsaw, Inc., Chicago. (Figure 4)

PNEUMATIC DRILL—with plastic case operates at 2500 r.p.m., is $6\frac{1}{4}$ inches in over-all length, and accommodates $\frac{1}{8}$-, $\frac{3}{16}$-, $\frac{1}{4}$-, of $\frac{5}{16}$-in. drills with Jacobs chuck. It has full ball-bearing construction, a motor of alloy steels, and a built-in visible oiler. The Aro Equipment Corporation, Bryan, Ohio. (Figure 5)

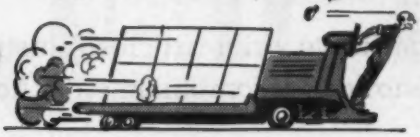
PORTABLE MIXER—features control of mixing speed and protection of motor from direct destructive mixing fumes. Motor may be a.c. or d.c. Desired mixing speeds are obtained by simple interchange of V-belts and pulleys. Two slow-speed propellers are easily adjusted. United Electric Motor Company, New York. (Figure 6)

POWER SAW—Unit with 12-in. saw will cross-cut material 14 inches wide by 1 inch, and 12 inches by 3 inches, and will rip up to 26 inches wide. It will also miter, bevel-cut off, double miter, and bevel rip. Unit is available in $1\frac{1}{2}$-, 2-, and 3-hp. sizes. DeWalt Products Corporation, Lancaster, Pa. (Figure 7)

RIVET DRIVER — operates pneumatically in a four-step cycle, and will drive and buck in one operation. Weighing $4\frac{1}{4}$ pounds, the machine is $9\frac{1}{2}$ inches long, has a spindle offset of $\frac{7}{8}$ inch, and a speed of 1000 r.p.m. forward and of 2000 r.p.m. reverse. Independent Pneumatic Tool Company, Chicago 7. (Figure 8)

SANDER—Model 1000 weighs less than 6 pounds, has a speed of 3500 oscillations per minute. It can be equipped with different types of sandpaper attachments for various abrading surfaces. Machine is started and controlled by a palm lever. Sundstrand Machine Tool Company, Rockford, Ill. (Figure 9)

SANDER—The Model R. sander is equipped with hand grips, and the balanced weight allows even pressure on the work. Has a reciprocating action of 3000 oscillations per minute. Comes equipped ready to plug in. Lintern Corporation, Nedco Division, Berea, Ohio. (Figure 10)

WHAT WAS THAT THAT JUST WENT BY? NOT A FOUR ★★★★ GENERAL BUT ANOTHER  LOAD OF WAR EQUIPMENT THAT WAS PUT TOGETHER IN RECORD TIME SINCE ··· THAT FAST-DRIVING RECESSED HEAD SCREW CAME ON THE JOB..... IT'S PHILLIPS ···

Sure — the news is swell! But the war isn't over yet. The heat's still on — and production speed is as vital as ever.

One of the surest ways to get more speed in your assembly operations is to put Phillips Recessed Head Screws in the hands of your workers. Hundreds of plants all over the country have standardized on the Phillips screw — and the results have been spectacular. Driving speed has often been doubled. Vital man hours have been saved. Production has been greatly increased — thanks to the Phillips Recess which makes power or spiral driving practical.

Some advantages of Phillips Recessed Head Screws are listed here. Check them against slotted head screws — or any other type you may be using. You'll quickly see why it costs less to use screws with the Phillips Recessed Head.

TO MAKE WARTIME QUOTAS AND PEACETIME PROFITS

Faster Starting: Driver point automatically centers in the Phillips Recess . . . fits snugly. Fumbling, wobbly starts, slant driving are eliminated. Work is made trouble-proof for green hands.

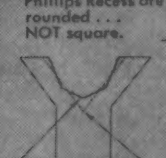
Faster Driving: Spiral and power driving are made practical. Driver won't slip from recess to spoil material or injure worker. (Average time saving is 50%.)

Easier Driving: Turning power is fully utilized. Workers maintain speed without tiring.

Better Fastening: Screws are set-up uniformly tight, without burring or breaking of screw heads. The job is stronger, and the ornamental recess adds to appearance.

IDENTIFY IT!

Center corners of Phillips Recess are rounded . . . NOT square.



Bottom of Phillips Recess is nearly flat . . . NOT tapered to a sharp point.

PHILLIPS Recessed Head SCREWS

WOOD SCREWS · MACHINE SCREWS · SELF-TAPPING SCREWS · STOVE BOLTS

23 SOURCES

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

MAINTENANCE SHORTS

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary maintenance accomplishments. Accepted articles will be paid for

Pipe Repaired Without Stopping Water

W. T. ESTLICK, Ansonia, Conn.

Some time ago a 2-in. pipeline that supplies water to flush and rinse tanks developed a serious leak. This pipe is connected to a 36-in. flume that conveys water from a nearby canal to a water turbine driving a generator set. The connection is in the turbine pit close to the turbine. The leak was close to the 2-in. shutoff valve and between it and the flume.

Because of snow and ice it was impossible to shut off the water supply quickly and vent the flume. The water in the flume has a static head of approximately 35 feet.

We prepared a 2-in. nipple about 15 inches long and cut a standard thread on one end. The other end was ground in a taper about 1½ inches long from full size to a feather edge, after which we threaded the tapered end with a thread about ½ inch longer than standard. Then we screwed a 2-in. gate valve on the standard thread end and opened the gate wide.

The defective pipe easily broke off at the leak. After removing the old piece, two men held the prepared nipple under the threaded hole in the flume, placing the beveled tip in the bottom of the opening at right angles to the side of the flume. Then they quickly swung the nipple up and into the opening. The open valve offered very little resistance to the water, and the nipple was screwed in and partly tightened. Then the valve was closed and the nipple fully tightened. The rest of the job was routine.

We were able to make this repair without a power interruption.

•

FIFTY DOLLARS

Will be paid for the best Maintenance Short published in each issue of *Factory* until further notice. (Do not submit Shorts that deal with production processes.)

All other Shorts accepted for publication will be paid for at attractive rates.

Contributors may submit as many items as they wish. Mail yours today!

Prize-winning short this month, "Removes 99 Percent of Iron Dust at Source," on this page

Removes 99 Percent of Iron Dust at Source

R. A. SHAW, Detroit

A vacuum dust collecting system is being successfully used in a Detroit diesel engine plant to remove cast-iron dust produced in milling cylinder blocks.

This dust formerly presented a troublesome problem. Aside from the health aspect, cast-iron dust can be the cause of much trouble with open-type motors. Also it is injurious to bearings. Hence, there was plenty of incentive for working out some successful method of removing it at the source.

The solution eventually adopted involved installing semi-circular exhaust hoods close to the milling cutters. It will be seen from Figure 1 that the openings of these ducts are closed by thin sheet metal except for a series of small openings at one edge, directly back of the cutters. As the result of this construction the air entering these openings has rather high velocity.

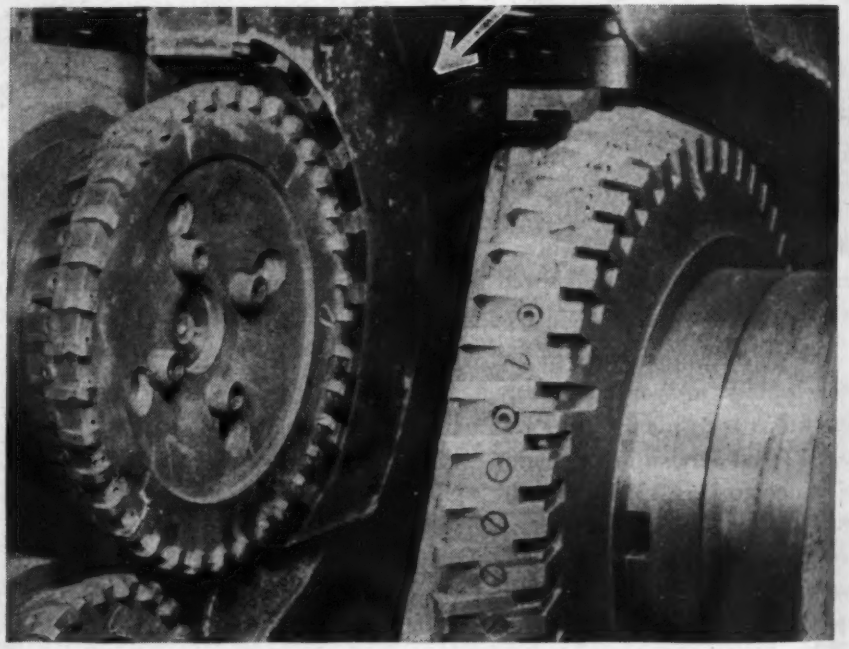
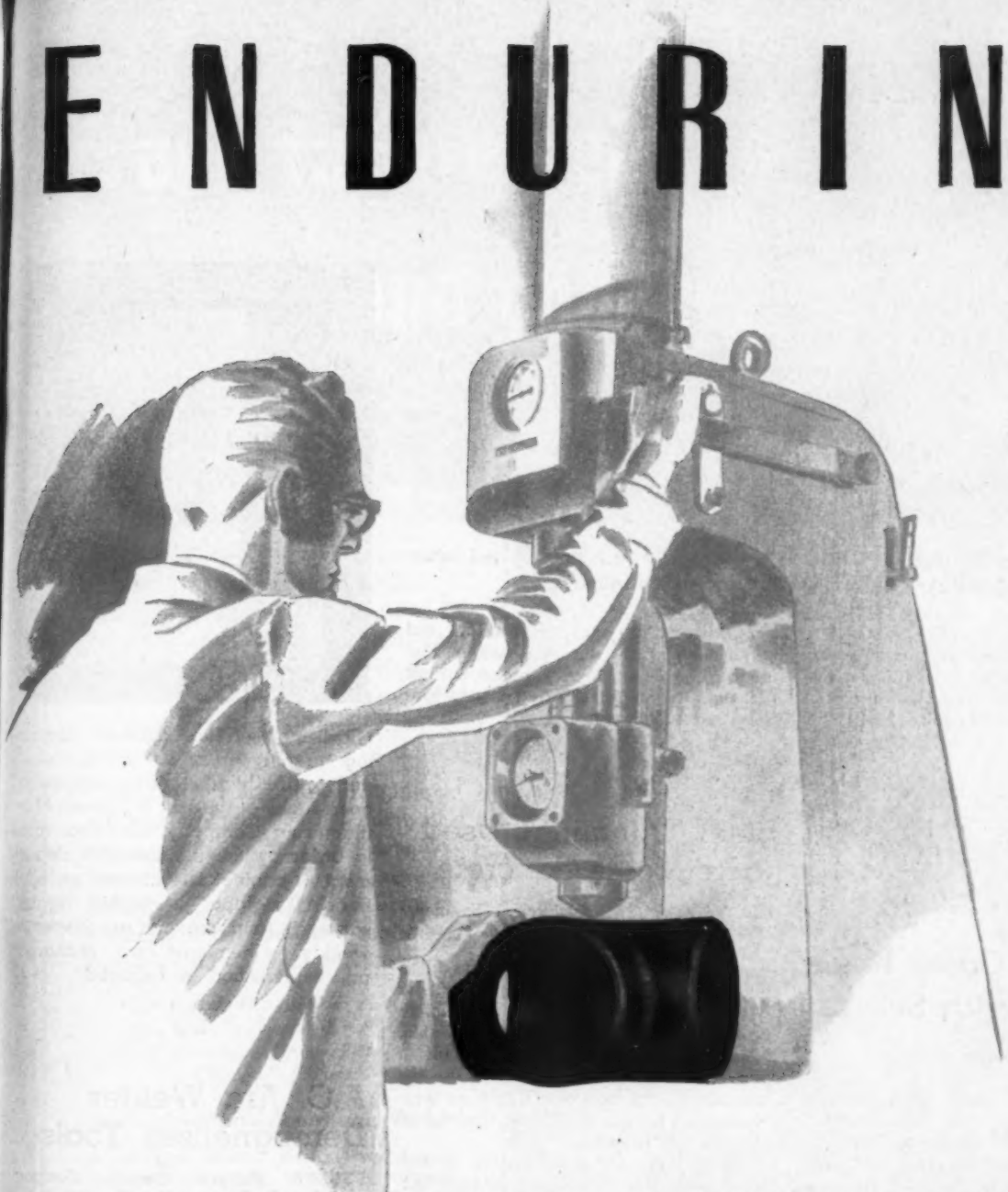


Figure 1. Arrow points to the thin sheet metal exhaust hoods, with openings at one edge directly back of the cutters

These hoods are connected to the regular exhaust system.

The effectiveness of this method of collecting cast-iron dust at the source is shown in Figure 2. Tube 1 contains the cast-iron dust collected, before installation of the exhaust system, after 48 hours' exposure from an area of 1 square foot at an elevation of 7 feet from the floor. This dust was produced by the machining of six cylinder blocks. Tubes 2 and 3 contain dust similarly collected after the machin-

ENDURING



The BRINELL testing machine, shown above in Tube Turns' laboratories, scientifically determines the hardness, or wear resistance, of finished fittings.

Endurance is indispensable in welding fittings, for the destructive forces in piping — strain, pressure, vibration, corrosion and erosion — are more *highly concentrated at the fittings.*

Tube Turns' exclusive manufacturing process forges fittings which virtually eliminate premature wear, leakage, and maintenance throughout the life of piping. Systematic hardness tests *insure* the enduring qualities possessed by all Tube-Turn seamless welding fittings.

TUBE TURNS (Inc.) Louisville, Kentucky. *Branch Offices: New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Dayton, Washington, D. C., Houston, San Francisco, Seattle . . . Distributors located in all principal cities.*

ARMY E NAVY M

TUBE-TURN

TRADE MARK

Welding Fittings and Flanges

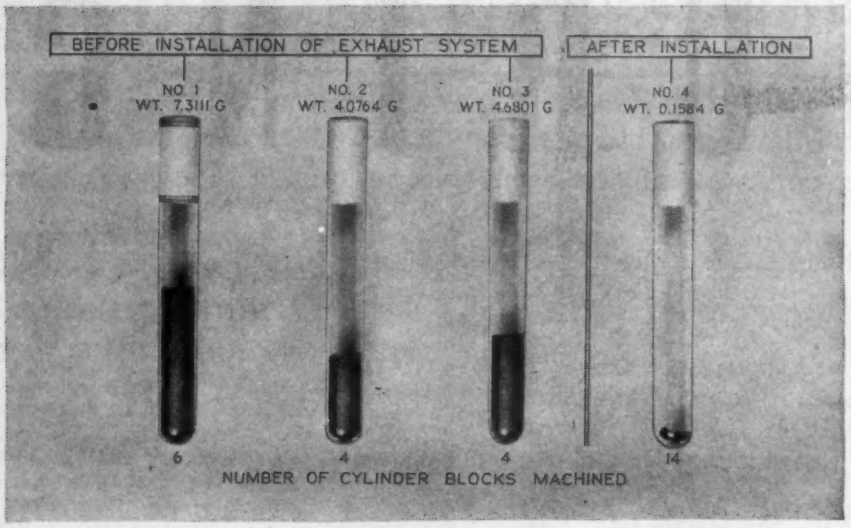


Figure 2. Amount of cast-iron dust taken from the air before and after installation of exhaust system shows 99 percent decrease

ing of four cylinder blocks. Tube 4 contains cast-iron dust collected the same way as before, but following installation of the exhaust system, after 14 cylinder blocks had been machined. The weight of the dust, in grams, is given at the top of each tube.

From these tests it appears that about 99 percent of the cast-iron dust is being collected as soon as it is formed, and thus is kept out of the atmosphere of the shop.

•

Protective Cases Made From Raceway Scraps

H. G. PACK, San Mateo, Calif.

Odds and ends of metallic raceway ranging from less than an inch to several feet in length are usually discarded. However, excellent metal protective cases can easily be made from them for such items as hacksaw blades, drill rods, small tubing, and other items of considerable length and small cross section which are scattered about the tool box or work bench.

Figure 1 shows end section of a case for hacksaw blades made from a length of raceway. The curved strip B normally slides in and out of channel A. The strip is pulled out and the ends bent up and rounded off with a file as shown in Figure 2. The channel is of course cut off to length to fit the completed tray. Finished case is shown in Figure 3.

•

Steel Trimmings Used to Reinforce Concrete

TED T. TYLASKA, Mechanical Engineer, Wyatt Metal & Boiler Works, Houston

Recently, our expansion program called for a new two-story office building. The steel shortage forced us to use all-concrete beams, instead of the customary steel beams. Reinforcing bars were difficult to secure. As a result we decided to use the trimmings from steel plates that we were fabricating, for the reinforcing steel for all our concrete beams and slabs.

These bars were approximately $\frac{3}{8}$ inch square, and served the purpose even better than we had expected. As our supply of the longer trimmings became exhausted, we merely welded shorter ones together. The forming of the stirrups was slightly more difficult, and the bars had to be heated to produce square bends.

Tensile tests of these trimmings were made. They were found to be nearly equal to that of regular reinforcing steel, and the burned edge was nearly equal to the deformations of the regular reinforcing steel. These trimmings are available as scrap from any boiler shop where plates are fabricated.

•

Glass-enclosed fire cabinets containing three types of fire extinguishers and a fire blanket have supplanted open racks at the Felt & Tarrant Manufacturing Company, Chicago. Built to order by the maintenance department, a cabinet is stationed on each floor. The door is sealed against sabotage, and contents are inspected weekly. Chemicals are recharged and replenished as required

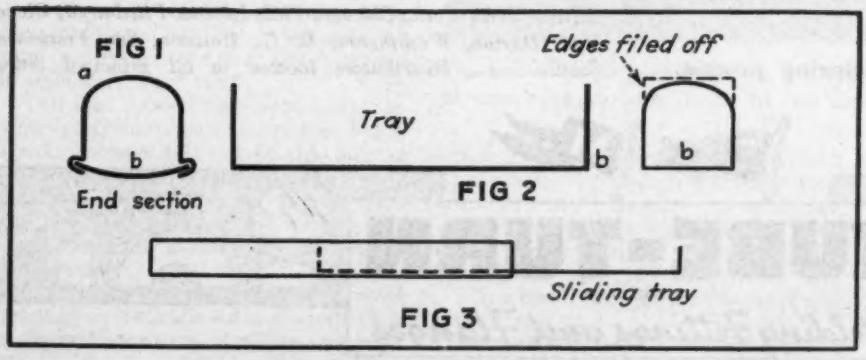
•

A.C. Arc Welder Demagnetizes Tools

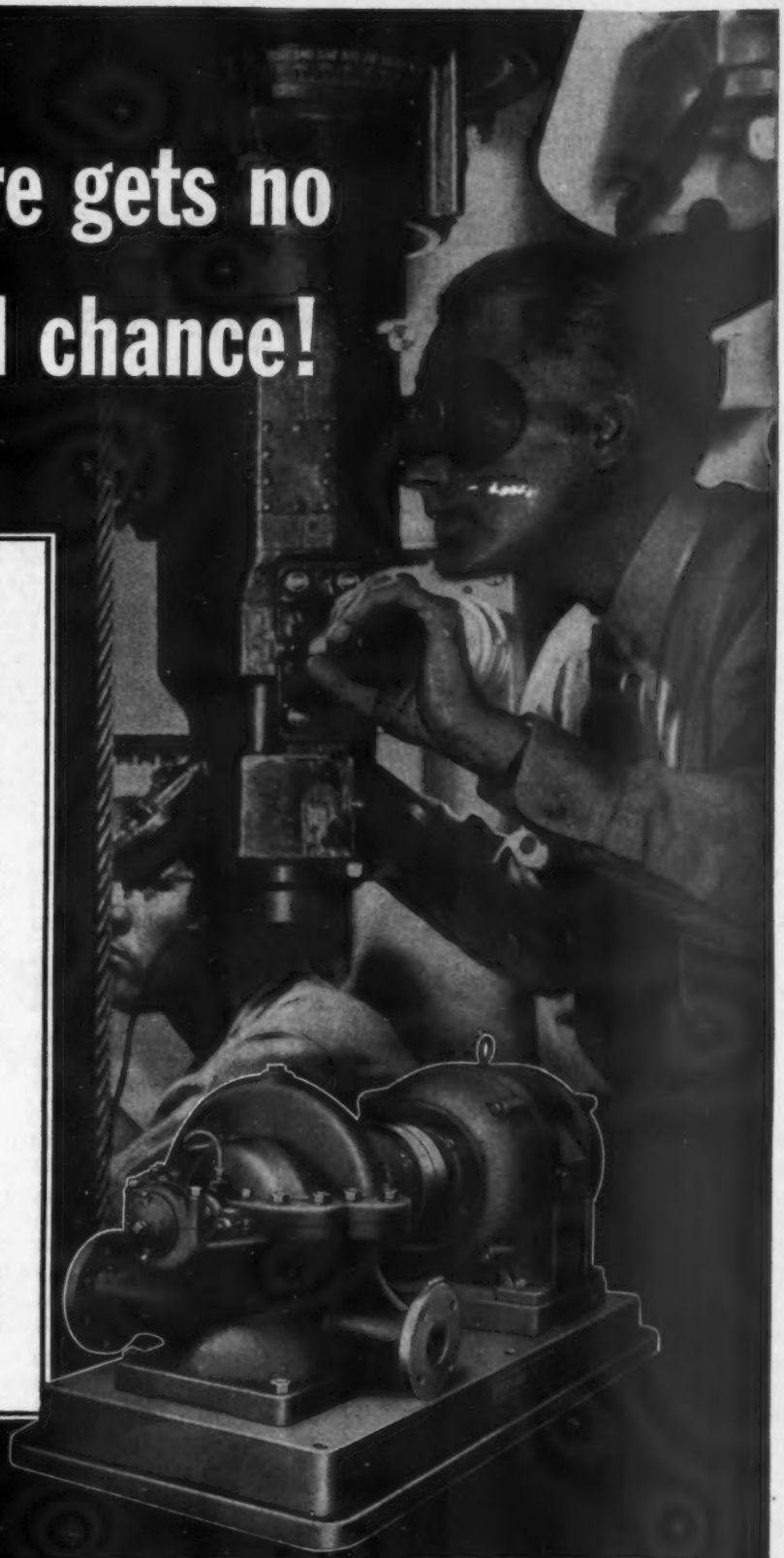
SOURCE: General Electric Company, Schenectady

The widely expanded use of highly hardenable alloy steels since the war began has brought to light numerous instances where permanent magnetism has caused trouble in arc welding, as well as in the operation of tools. A.c. arc-welding transformers, equipped with stepless control, are now being used to demagnetize steel parts by a method similar to that employed by jewelers in demagnetizing watches, reports R. F. Wyer, welding engineer.

This method was used by the Chrysler tank plant in Detroit, to remedy trouble caused by metal parts clinging to dies which had become magnetized. Five or six turns of cable were wrapped around the die and a heavy 60-cycle alternating current from a 500-amp. a.c. welder was passed through the cable, the current then being gradually decreased by turning the current-control crank on the welder. This procedure was so successful, it is now regularly employed.



...and failure gets no second chance!



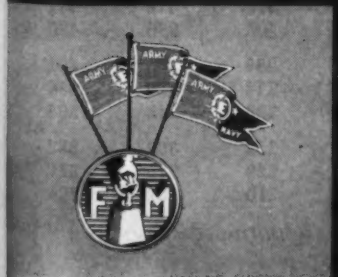
"Surface!" With that command life itself hangs in the balance . . . depends upon pumps . . . reliable and efficient pumps that dare not fail *once!* It's a critical moment at any time . . . on any submarine, that demands the highest standards of perfection in pumping equipment.

That's why Fairbanks-Morse Pumps are used in United States submarine service. You can rely on Fairbanks-Morse Pumps . . . can know in advance that their mechanical superiority assures you dependable, economical operation now and for years to come.

For consultation without obligation, write Fairbanks, Morse & Co., 210 Fairbanks-Morse Building, Chicago 5, Illinois.

Fairbanks-Morse Centrifugal Pumps

A complete "family" of single-stage, split-case pumps for low, moderate, medium, and high heads, is described in Bulletin 5810D. Many other bulletins available on other types.



FAIRBANKS-MORSE

DIESEL ENGINES · PUMPS · MOTORS · GENERATORS · WATER SYSTEMS · SCALES · STOKERS · FARM EQUIPMENT · RAILROAD EQUIPMENT

Pumps

Torque at Various Speeds and Horsepower

THE TABLE gives the torque in inch-pounds developed at speeds of 100 to 5000 r.p.m. for horsepowers ranging from 1 to 45.

To use the table, find the value of torque shown by the horizontal line representing speed in the column corresponding to the horsepower. For example, a 20-hp. motor will develop 700 inch-pounds torque at 1800 r.p.m.

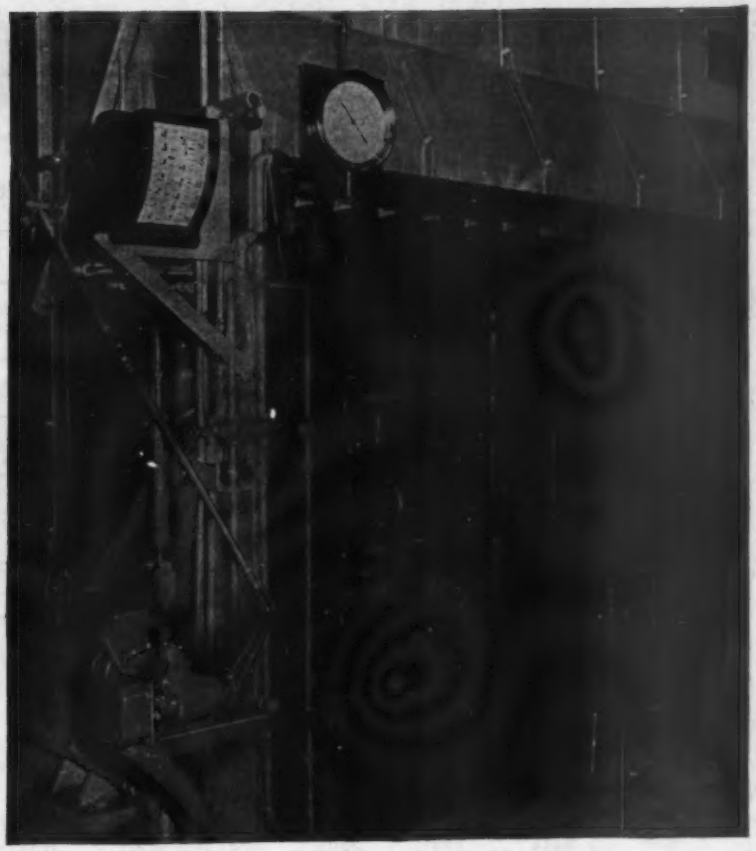
Then divide the value of the torque by the radius of the pulley to obtain the effective belt pull; or by the pitch radius of a gear to obtain the force on the teeth at the pitch radius; or the pull on a chain.

Assume, for example, that a 10-hp., 1800-r.p.m. motor has a 5-in. pulley. Torque developed is 350 inch-pounds. Pull on the belt will be $350 \div 2.5 = 140$ pounds.

If a 6-in. pitch-diameter gear were used in place of a pulley, the force on the gear teeth at pitch radius would be $350 \div 3 = 116.6$ pounds.

	HORSEPOWER											
R.P.M.	1	2	3	4	5	6	7	8	9	10	12	14
100	630	1261	1891	2521	3151	3782	4412	5042	5672	6303	7563	8824
150	420	840	1261	1681	2101	2521	2941	3361	3781	4202	5042	5882
200	315	630	945	1261	1575	1891	2206	2521	2836	3151	3782	4412
250	252	504	756	1008	1260	1513	1765	2017	2269	2521	3025	3529
300	210	420	630	840	1050	1261	1471	1681	1891	2101	2521	2941
350	180	360	540	720	900	1080	1261	1441	1621	1801	2161	2521
400	158	315	473	630	788	945	1104	1261	1418	1576	1891	2206
450	140	280	420	560	700	840	980	1120	1261	1401	1681	1961
500	126	252	378	504	630	756	882	1008	1134	1261	1513	1765
550	115	229	344	458	573	688	802	917	1031	1146	1375	1604
600	105	210	315	420	525	630	735	840	945	1050	1261	1471
650	97	194	291	388	485	582	679	776	873	970	1164	1357
700	90	180	270	360	450	540	630	720	810	900	1080	1261
750	84	168	252	336	420	504	588	672	756	840	1008	1176
800	79	158	236	315	394	473	551	630	709	788	945	1103
850	74	148	222	297	371	445	519	593	667	741	889	1038
900	70	140	210	280	350	420	490	560	630	700	840	980
950	66	133	199	265	332	398	464	531	597	663	796	929
1000	63	126	189	252	315	378	441	504	567	630	756	882
1100	57	115	172	229	286	344	401	458	516	573	688	802
1200	53	105	158	210	263	315	368	420	473	525	630	735
1300	48	97	145	194	242	291	339	388	436	485	582	679
1400	45	90	135	180	225	270	315	360	405	450	540	630
1500	42	84	126	168	210	252	294	336	378	420	504	588
1600	39	79	118	158	197	236	276	315	355	394	473	551
1700	37	74	111	144	185	222	260	296	334	371	445	519
1800	35	70	105	140	175	210	245	280	315	350	420	490
1900	33	66	100	133	166	199	232	265	299	332	398	464
2000	32	63	95	126	158	189	221	252	284	315	378	441
2100	30	60	90	120	150	180	210	240	270	300	360	420
2200	29	57	86	115	143	172	201	229	258	286	343	401
2300	27	55	82	110	137	164	192	219	247	274	329	384
2400	26	53	79	105	131	158	184	210	236	263	315	368
2500	25	50	76	101	126	151	176	202	227	252	302	353
2750	23	46	69	92	115	138	160	183	206	229	275	321
3000	21	42	63	84	105	126	147	168	189	210	252	294

(Continued on page 166)



L&N Type P Combustion Control on a B & W Integral-Furnace Boiler. Control Panel at left arrives completely assembled and ready for outside connection; carries the Master Controller, Furnace Pressure Controller and all push buttons. A typical valve drive is the one for uptake damper, shown alongside the boiler.

NEW COMBUSTION CONTROL SYSTEM
Meets Needs of War-Busy Textile Plant

Shown here is a typical application of the entirely new L&N Type P Combustion Control system especially suited to the needs of "smaller" power plants and to many war plants:

1. It is Simple. One Controller (the Master) regulates both fuel and air for all boilers. Another Controller (one for each boiler) regulates furnace pressure. Both are entirely electrical; they move the dampers, valves and levers by means of electric-motored Drive Units.

2. It is Centralized and Flexible. Without moving from Panel, operator can switch from fully-automatic control to either base-load or push-button control; can operate some boilers on automatic control and some on push-button; can change fuel-air ratio of any boiler or boilers. In brief, he can suit the operation to the plant requirements.

3. One Drive Unit for each damper, etc.; no piping or shafting; no interconnecting linkages; connections of Unit to Control Panel are through an electrical conduit. Drive Units cannot be back-driven even when power is off; and all but the smallest can be equipped with hand-wheel drives if desired. Only power is from 110-volt a-c lighting or similar circuit.

4. Type P is Easy to Install. With no compressors, piping or line shafting, the labor and time of installing are minimum. Our factory assembly of the Control Panel further reduces installation costs. We can supply panel individually, or as part of group panel, or on boiler board which includes both control and instruments.

If you have a combustion-control problem which does not require central-station type equipment, outline the situation and we will promptly send specific facts about Type P Control.

Jrl Ad N-01P-163(3a)

A Slogan For Every American

LEEDS & NORTHRUP COMPANY, 4909 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS • TELEMETERS • AUTOMATIC CONTROLS • HEAT-TREATING FURNACES

Torque at Various Speeds and Horsepower *(continued from page 164)*

	HORSEPOWER											
R.P.M.	1	2	3	4	5	6	7	8	9	10	12	14
3250	19	39	58	78	97	116	136	155	175	194	233	272
3500	18	36	54	72	90	108	126	144	162	180	216	252
3750	17	34	50	67	84	101	118	134	151	168	202	235
4000	16	32	47	63	79	95	110	126	142	158	189	221
4250	15	30	44	59	74	89	104	119	133	148	178	208
4500	14	28	42	56	70	84	98	112	126	140	168	196
4750	13	27	40	53	66	80	93	106	119	133	160	186
5000	13	25	38	50	63	76	88	101	113	126	151	177

R.P.M.	16	18	20	22	24	26	28	30	35	40	45
100	10084	11345	12605	13866	15126	16387	17647	18908	22059	25210	28361
150	6723	7563	8403	9244	10084	10924	11765	12605	14706	16807	18907
200	5042	5672	6303	6933	7563	8193	8824	9454	11029	12605	14181
250	4034	4538	5042	5546	6050	6555	7059	7563	8824	10084	11345
300	3361	3782	4202	4622	5042	5462	5882	6303	7353	8403	9454
350	2881	3241	3601	3962	4321	4682	5042	5402	6303	7203	8103
400	2521	2836	3151	3466	3782	4097	4412	4727	5515	6303	7090
450	2241	2521	2801	3081	3361	3641	3922	4202	4902	5602	6303
500	2017	2269	2521	2773	3025	3277	3529	3782	4412	5042	5672
550	1833	2063	2292	2521	2750	2979	3209	3438	4011	4584	5156
600	1681	1891	2101	2311	2521	2731	2941	3151	3676	4202	4727
650	1551	1745	1939	2133	2327	2521	2715	2909	3394	3879	4363
700	1441	1621	1801	1981	2161	2341	2521	2701	3151	3601	4052
750	1345	1513	1681	1849	2017	2185	2353	2521	2941	3361	3782
800	1261	1418	1576	1733	1891	2048	2206	2363	2757	3151	3545
850	1186	1335	1483	1631	1780	1928	2076	2224	2595	2966	3337
900	1120	1261	1400	1541	1681	1821	1961	2101	2451	2801	3151
950	1061	1194	1327	1460	1592	1725	1858	1990	2322	2654	2985
1000	1008	1134	1261	1387	1513	1639	1765	1891	2206	2521	2836
1100	917	1031	1146	1261	1375	1490	1604	1719	2005	2292	2578
1200	840	945	1050	1155	1260	1366	1471	1576	1839	2101	2363
1300	776	873	970	1067	1164	1261	1357	1454	1697	1939	2182
1400	720	810	900	990	1080	1170	1261	1351	1576	1801	2026
1500	672	756	840	924	1008	1092	1177	1261	1471	1681	1891
1600	630	709	788	867	945	1024	1103	1182	1379	1576	1773
1700	593	667	741	816	890	964	1038	1112	1298	1483	1668
1800	560	630	700	770	840	910	980	1050	1225	1401	1576
1900	531	597	663	730	796	862	929	995	1161	1327	1493
2000	504	567	630	693	756	819	882	945	1103	1261	1418
2100	480	540	600	660	720	780	840	900	1050	1200	1351
2200	458	516	573	630	688	745	802	859	1003	1146	1289
2300	438	493	548	603	658	712	767	822	959	1096	1233
2400	420	473	525	578	630	683	735	788	919	1050	1182
2500	403	454	504	555	605	655	706	756	882	1008	1134
2750	367	413	458	504	550	596	641	688	802	917	1031
3000	336	378	420	462	504	546	588	630	735	840	945
3250	310	349	388	427	465	504	543	582	679	776	873
3500	288	324	360	396	432	468	504	540	630	720	810
3750	269	303	336	370	403	437	471	504	588	672	756
4000	252	284	315	347	378	410	441	473	552	630	709
4250	237	267	297	326	356	386	415	445	519	593	667
4500	224	252	280	308	336	364	392	420	490	560	630
4750	212	239	265	292	318	345	372	398	464	531	597
5000	202	227	252	277	303	328	353	378	441	504	567

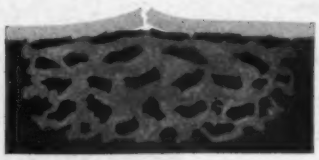
is a Volcano!

THIS IS HOW YOUR METAL CAN BE SAVED BY

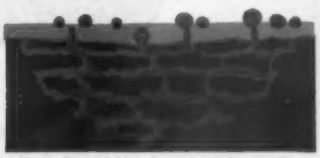
TOTRUST the Penetrating Protective Enamel

Large scale diagram of rust-pit containing oxygen, moisture, carbon, sulphur and other impurities, all of which promote RUST. To make the test more severe, *wet* this rust-pit with water.

When you apply TOTRUST by brush or spray, see what happens! TOTRUST immediately begins to *penetrate!* Burrows down into the rust-pit, displacing moisture.



Rust action is not stopped by merely painting *over* rust-pits!



Watch those globules of water; forced *up* to the surface — where they can evaporate harmlessly — as TOTRUST goes deeper and deeper.

With moisture now expelled, the rust particles are *surrounded* and *sealed* by this penetrating, rust inhibitive TOTRUST. Rust has been stopped at its source!

Do You Realize What Rust Means?

EACH rust-pit — however small — on your irreplaceable metal equipment or structures is a miniature volcano whose destructive action — if unchecked — will in time completely destroy everything in its path!

Rust is caused by the action of oxygen, moisture, and impurities on metal which often expand to several times the original volume of unrusted metal. When rust-pits are merely painted *over*, this expanding process is not stopped any more than by trying to cap a volcano to stop the action going on inside. (See diagram above as to how Rust action breaks the *surface* paint film unless the expansion itself is stopped.)

Study the diagrams at the right. They point the way to important maintenance economies which, for example, in one industrial application saved as much as 4,000 lbs. of metal *per month* from the scrap pile! Note how TOTRUST *penetrates into* the rust pits — *displaces* moisture —*seals* and surrounds rust particles — *stops rust at its source.*

NOTE THESE TOTRUST ADVANTAGES

1. PENETRATION into rust-pits.
2. DAMP, RUSTED SURFACES safely painted.
3. RUST STOPPED at its source.
4. RESISTANCE to weather, abrasion and fumes.
5. EXCELLENT covering power.
6. WIDE RANGE OF COLORS.

For 15 years the Wilbur & Williams Company has pioneered in this specific field. The roster of TOTRUST users reads like a "Who's Who" of American Industry.

Write for the name of the nearest Protectioneer or for full technical information on the prevention of rust in your plant.

protectioneering IS OUR JOB!

The WILBUR & WILLIAMS COMPANY

Dept. 23
PARK SQ. BUILDING,
BOSTON 16, MASS.

145 PROTECTIONEERS AND OVER 800 STOCKING DISTRIBUTORS FROM COAST TO COAST

The "Silent" Weapon *that's making a* Big NOISE

Official U. S. Navy Photograph

INVISIBLY, under a mantle of night, twin shafts of steel advance swiftly through the water to within torpedo range of the enemy supply ship. Beneath, in the sub, a crew of young Americans waits tensely for a command. Then: "Up periscope." Now their prey is framed in the cross-hairs. "Fire one!" Their tin fish doesn't miss.

As operations have extended over new continents and new oceans in this vast, global conflict, the submarine has taken on greater and greater importance as a primary *offensive* weapon for the United Nations.

So today at The Electric Boat Company, one of the nation's foremost sub builders, an army of men and women is working to give America the world's greatest underseas fleet. And here, again, you find modern DeVilbiss Spray Painting Equipment doing its part. Officials of Electric Boat state that *"one man using DeVilbiss Spray Equipment accomplishes what four did previously with hand brushes."*

Whatever your company's job in this war, there is DeVilbiss Spray Painting Equipment that will help *you* get the work out faster with less man hours of labor. After "V" Day, too—no matter how your peacetime products may differ from those you are making today—you can depend on DeVilbiss for the time-saving answer to any coating or painting problem.

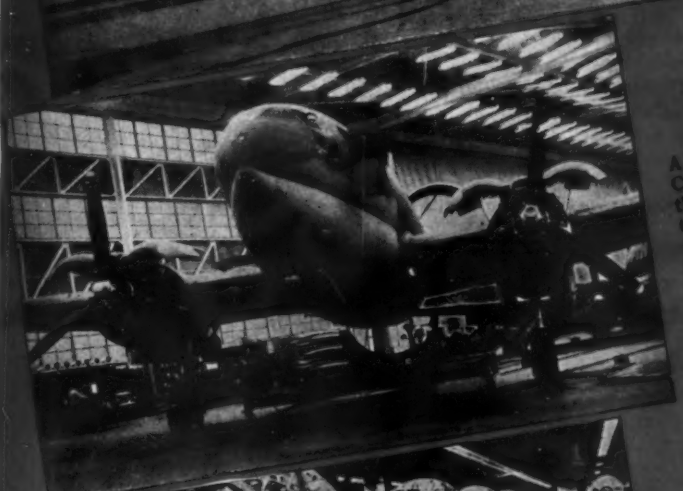
THE DEVILBISS COMPANY, TOLEDO 1, OHIO
Canadian Plant: Windsor, Ontario

DE VILBISS
Spray Systems

SPRAY EQUIPMENT • EXHAUST SYSTEMS • AIR COMPRESSORS • HOSE & CONNECTIONS

Curtiss Commando FLIES SOONER

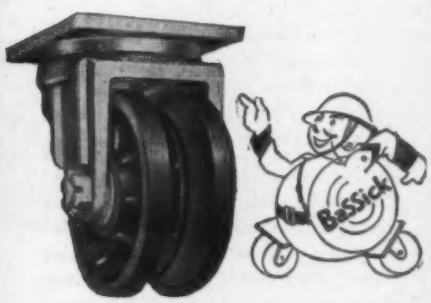
C46 Commando on its production cradle rolls up to the final rail station on four No. 10931-2 Precision "Grooved-Wheel" Casters.



A full-grown C46 leaves the cradle to take its first steps to the last stop in the hangar for engine testing.

Completely assembled engines for C46 Commando arrive at mounting station on dollies with Bassick heavy-duty grooved-wheel casters.

...BECAUSE IT "FLEW" THROUGH PRODUCTION ON BASSICK "GROOVED-WHEEL" CASTERS



Curtiss-Wright production engineers were among the first to take advantage of the schedule-beating opportunity presented by a "Caster-eased" production line.

Bassick "Grooved-Wheel" Casters on angle floor tracks make production lines compact, fast-moving, flexible — at low cost. The system can be re-arranged as conditions change and the caster-equipped trucks and dollies can roll on floors as well as tracks.

Bassick "Caster-eased" production lines are also helping deliver the goods in other aircraft, landing barge, tank engine and Diesel motor plants from coast to coast. Made in 4", 6", 8" and 10" sizes, the "Grooved-Wheel" Casters will handle the heaviest burdens.

Fitting casters to your type of production and materials-handling problem is Bassick's business.— the largest of its type in the world.

Bassick MAKING MORE KINDS OF CASTERS ... MAKING CASTERS DO MORE

THE BASSICK COMPANY
BRIDGEPORT 2, CONN.
Division of Stewart-Warner Corp., Chicago, Ill.
Canadian Factory: Stewart-Warner-Alemite Corporation of Canada, Ltd., Belleville, Ont.

JOHNSON BRONZE

Ledaloyl SELF LUBRICATING BRONZE

POWDER METALLURGY

- *Eliminates Machining*
- *Self Lubricating*

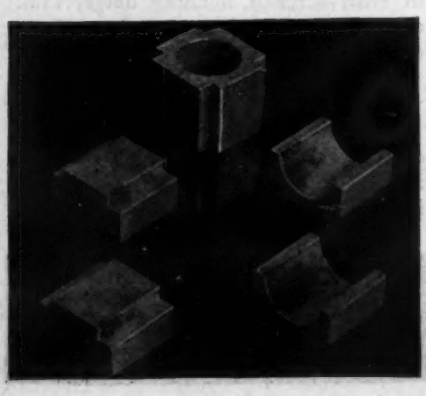
Bearings, bushings or other parts made from Johnson LEDALOYL are usually lower in cost . . . more efficient in operation . . . than when manufactured by any other method.

Johnson LEDALOYL is manufactured from pre-cast bearing bronze. This provides complete control over the bearing structure and lubricating action . . . provides uniform strength and longer life.

Excellent delivery is available on parts made from LEDALOYL. Write — TODAY — for complete information and a copy of our catalogue . . . listing more than 2000 stock sizes.

JOHNSON BRONZE
512 SOUTH MILL ST.
NEW CASTLE, PA.

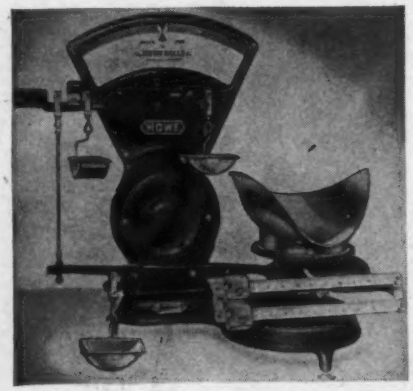
Ledaloyl is ideal for odd or intricate shapes as it eliminates all machining, provides self-lubrication.



WHAT'S NEW IN EQUIPMENT

Double Ratio Scale

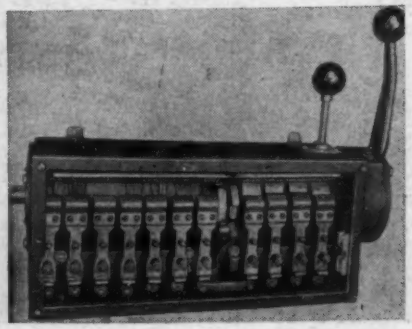
Double ratio scale, designated as Type 113-C, is said to be especially adapted for counting large quantities of small parts because of the unusually high sensitivity provided by a third pan attached to the lower beam lever. No ratio charts, reference tables, or mental calculations are necessary. Three pan counting scales are obtainable in two regular ratio combinations: 100:1-10:1-10:1, and 99:1-9:1-9:1. Other ratios



are supplied on special order. Total counting capacity is 40 pounds, and total weighing capacity, provided by two beams, is 20 pounds by 1 ounce. Scale platform measures 8¾ inches in diamater and is beaded to hold a scoop 19½x10x6 inches. Over-all height and length of scale is 27 inches, and over-all width is 15 inches. Accessories for both magnifying and illuminating the reading point are available. The Howe Scale Co., 2941 Scale Ave., Rutland, Vt.

Power Truck Controller

Model M-79 four-speed reversing controller is designed to prevent excessive waste of motor current in manufacturer's own electric and gas-electric trucks, when operating with resistance-type control for protracted periods at first, second, and third speeds. This controller uses resistance on the first speed only, and claims added power saving by the manipulation of the motor fields, which are connected in series on first and second speeds, and thereby produce greater torque with less current consumption. Controller is enclosed in welded housing that is said to be dust-tight and flashproof. The Elwell-Parker Electric Co., Cleveland 14.



Hand Cleaner

"Flix" is a hand-sized, semi-quilted, porous pad containing an absorbent substance that is said to be effective in removing all types of oil from the hands or arms, leaving them clean and dry. It is rubbed on the skin vigorously like a paper towel. Manufacturer claims that it (1) prevents oil dermatitis, (2) is economical, because it can be used repeatedly and saves soap, (3) will not readily burn, even when oil soaked, and therefore removes hazard of spontaneous combustion, and (4) can be used to remove oil from machine parts preparatory to painting. Waverly Petroleum Products Co., Philadelphia 6.

Compressed Air Filter

Compressed air line filter is said to feature greater flexibilty through provision of six hose outlets in manifold, and a self-dumping water trap. Hose outlets are ⅜-in. size

to accommodate snap-on hose connections. Interior parts of water trap are heavily plated to reduce corrosion. Closed float is stated to insure positive opening and closing of automatic discharge valve. Manufacturer claims advantages of prolonged life and increased efficiency of air tools and pneumatic equipment through elimination of dust, rust scale, oil, and water in air lines. Filters, Inc., P. O. Box 471, Glendale, Calif.

Fluorescent Fixture

All-purpose fluorescent fixture consists of a basic chassis with accessories for adaptation to various structural conditions, for use in offices, drafting rooms, and labora-

No Other Type of Belting Can Equal LEATHER BELTING in *Ease of Maintenance!*

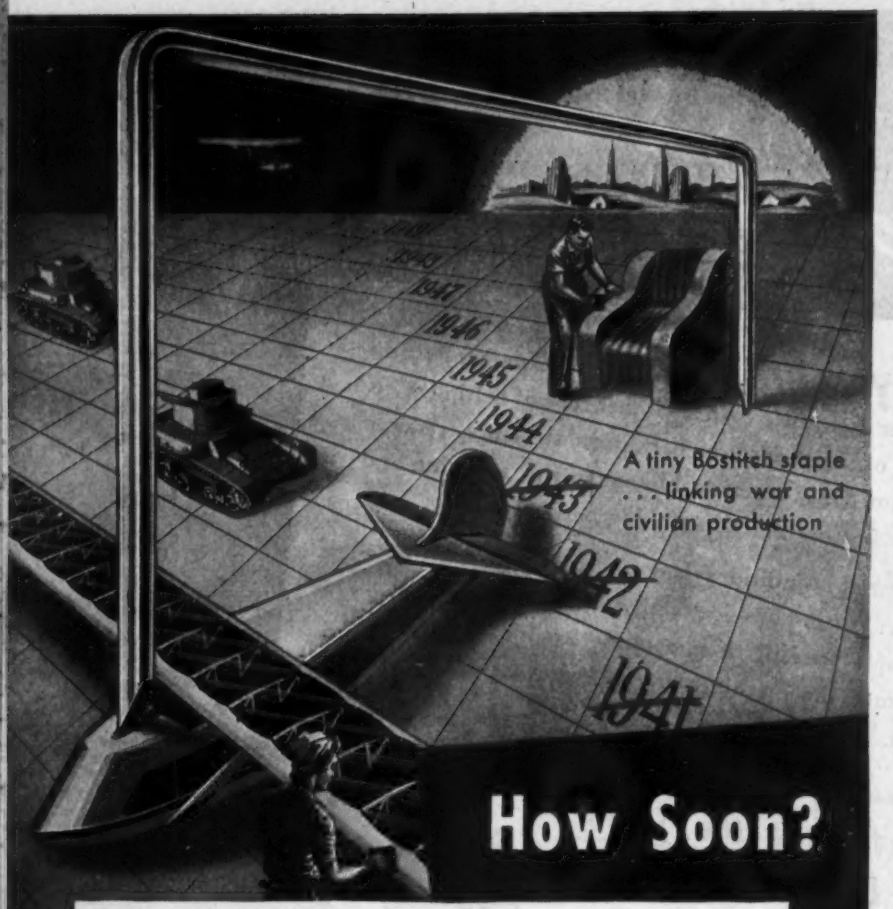
. . . Here's Why: Over a long period of time Leather Belting has proven to have a longer useful life than any other type of belting. This fact in itself, the result of Leather's tough, fibrous structure, reduces maintenance to a minimum. Only a reasonable amount of attention and care is required to keep a Leather Belt functioning perfectly.

Even under severe operating conditions and unusual loads, the great tensile strength of Leather Belting provides a high safety factor. It seldom, if ever, fails without ample warning of impending trouble . . . and will usually carry through until the machines are shut down for scheduled check-up and lubrication.

. . . Here's How to get Maximum Service from your LEATHER BELTING

Merely by following a few simple rules, you can get the most from your Leather Belting with the least amount of care. This booklet contains a complete plan for proper Leather Belt maintenance. A copy should be in the hands of every man in your plant who has anything to do with Leather Belting. They may be obtained from your Leather Belting Supplier . . . or directly from us . . . without cost or obligation.

AMERICAN LEATHER BELTING ASSOCIATION • 53 Park Row, NEW YORK 7, N.Y.



How Soon?

A MONTH . . . or many months . . . to the day *your* industry will get the "go ahead" on civilian goods . . . to create jobs for men as they are released from service or war work?

How soon? What products can come first? *Most important*—will *you* be ready . . . on that day . . . to change quickly from gliders to furniture . . . jeeps to cars . . . shells to cosmetics . . . or whatever it may be?

If your planning involves fastening . . . Bostitching offers you *speed* . . . often 50% more speed . . . over nailing, riveting, welding, gluing, or tieing. 800 different Bostitch machines . . . to stitch paper, or steel . . . tack insulation, shingles, wall board . . . seal shipping containers . . . encircle wires or cords (as shown below).

Investigate Bostitching . . . especially the new Bostitch

"When-Available" Plan

which gives priority to your future needs . . . helps *you* to prepare and us to plan . . . to meet opportunities quickly as they arise . . . without interfering with war work. Write for "W-A" folder.

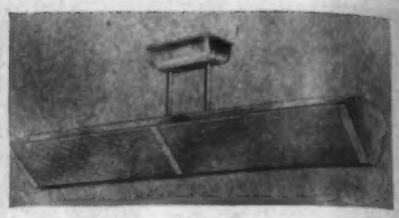
Bostitch (Boston Wire Stitcher Company), 70 Blackmore Street, East Greenwich, R. I. (Bostitch-Canada, Ltd., Montreal).

Below: "Wrap-Around" Stapler, newest of 800 Bostitch staplers, tackers, stitchers.

BOSTITCH

fastens it better AND FASTER with wire

ALL TYPES OF STAPLES APPLIED BY MACHINES
ALL TYPES OF MACHINES FOR APPLYING STAPLES



tories. Unit may be mounted as a shielded or unshielded fixture, and includes four 40-watt lamps and ballasts, for 110- to 220-volt, 60-cycle operation as standard equipment. Installation time and maintenance are said to be reduced by design and accessibility of parts. Diffusing panels are of fluted, frosted glass, positioned to obtain an even distribution of light. Over-all length of unit is 49¼ inches. Unshielded and shielded units are 11¼ and 13¾ inches in over-all width, respectively, and 5⅞ and 7 inches in over-all heights, with average weights of 30 and 40 pounds. Sylvania Electric Products Inc., 60 Boston St., Salem, Mass.

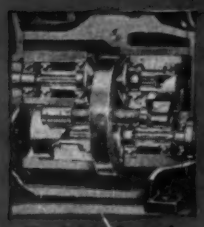
Wire Solder

Fluxed wire solder called Fluxrite contains flux in longitudinal helical grooves on the surface. Manufacturer claims that flux liquefies and flows on the work before the solder melts, thereby resulting in stronger and better joints. Other advantages claimed are continuous flux flow at all times from more than one flux-filled groove, and ability to check constant flow of flux visibly, to avoid gaps or voids. Fluxrite is available in two compositions designated as Red Stripe and Green Stripe, as indicated by the color of the flux for easy identification. National Lead Co., 111 Broadway, New York 6.

Portable Dust Collector

Improved features, including new intake and exhaust design, are announced for Filtaire portable dust collector, model No. 2. Air, which is drawn in by fan in front, is deflected upward by a baffle plate and exhausted through two replaceable filters at the top. The ½-hp. motor, which drives fan through a shaft and V-belt, is located out of airstream behind baffle plate. Drive

Gearhead Unit



Variable Speed Unit

easily combine to form a compact integral power unit

Fan-cooled Motor

which adds greatly to the economy, safety, compactness and appearance of the finished product

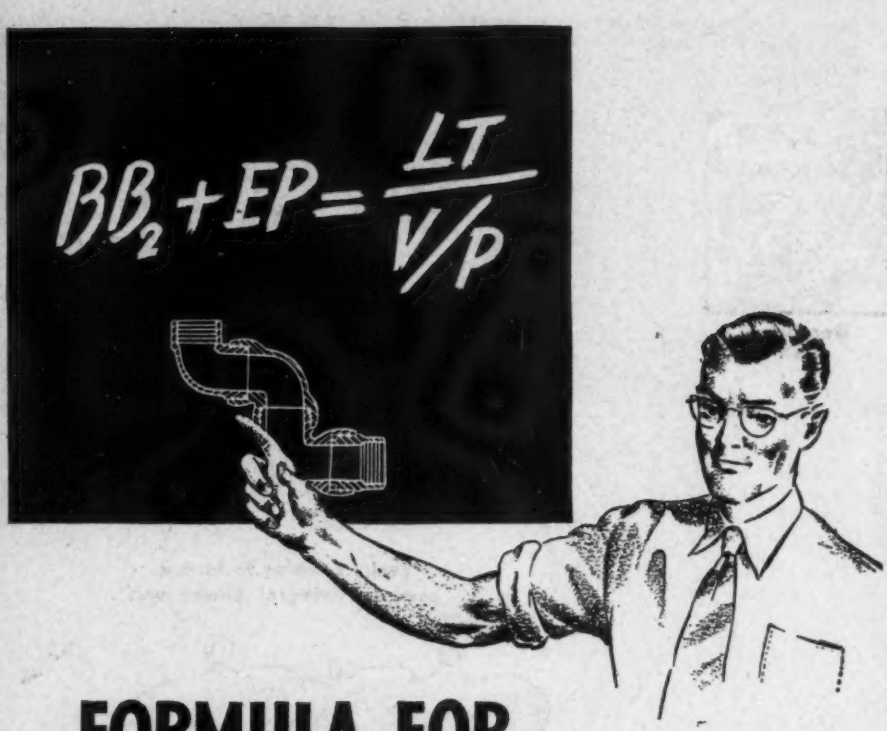
easy does it

This is just one of the thousands of combinations that can be secured in the Master Line, which is the most versatile, the most flexible line of motor equipment available.

Single phase, squirrel cage, slip ring, multi-speed, synchronous, direct current, enclosed, splash-proof, fan-cooled, explosion proof, elevator, hoist, reversing, gearhead, Speed-rangers, Unibrake, vertical and horizontal flange units . . . all are designed so they can be easily combined to provide the power drive best suited to each application.

Investigate Master's unusual ability to serve you economically with motors that really fit the job exactly.

THE MASTER ELECTRIC COMPANY
DAYTON 1, OHIO



FORMULA FOR PERFECT *flexibility*

When you need Swivel Joints, you certainly want maximum flexibility with minimum torque.

Specify CHIKSAN Ball-Bearing Swivel Joints and you specify the only joint built to the formula for perfect flexibility:

BB_2 = Double rows of ball bearings.
EP = Effective Packing Element— self-adjusting for:
V/P = Pressure or Vacuum Service
LT = Resulting Low Torque.

CHIKSAN Ball-Bearing Swivel Joints are supplied in over 500 different Types, Styles and Sizes. Manufactured in steel, malleable iron, bronze and aluminum. Sizes from ⅜" to 12"; larger sizes to order for pressures to 300 lbs. and to 3,000 lbs. at 225° F. and for pressures to 500 lbs. at 700° F. End connections optional. Write for latest Chiksan Catalog and Engineering Data.

CHIKSAN REPRESENTATIVES IN PRINCIPAL CITIES
DISTRIBUTED NATIONALLY BY CRANE CO.

CHIKSAN TRADE MARK REG.

CHIKSAN TOOL COMPANY
Ball Bearing SWIVEL JOINTS for ALL PURPOSES
BREA, CALIFORNIA

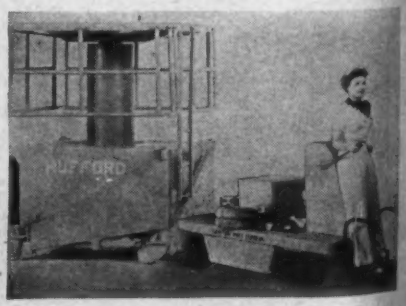
shaft is mounted front and rear in dust-proof bearings that have grease-gun fittings. Adjustments are provided for raising and lowering collector unit, also for moving it backwards and forwards, so that no special hoods or ducts are required. Unit can be moved anywhere within range of 110-volt power supply. Edward Blake Co., 634 Commonwealth Ave., Newton Centre 59, Mass.

Safety Goggle

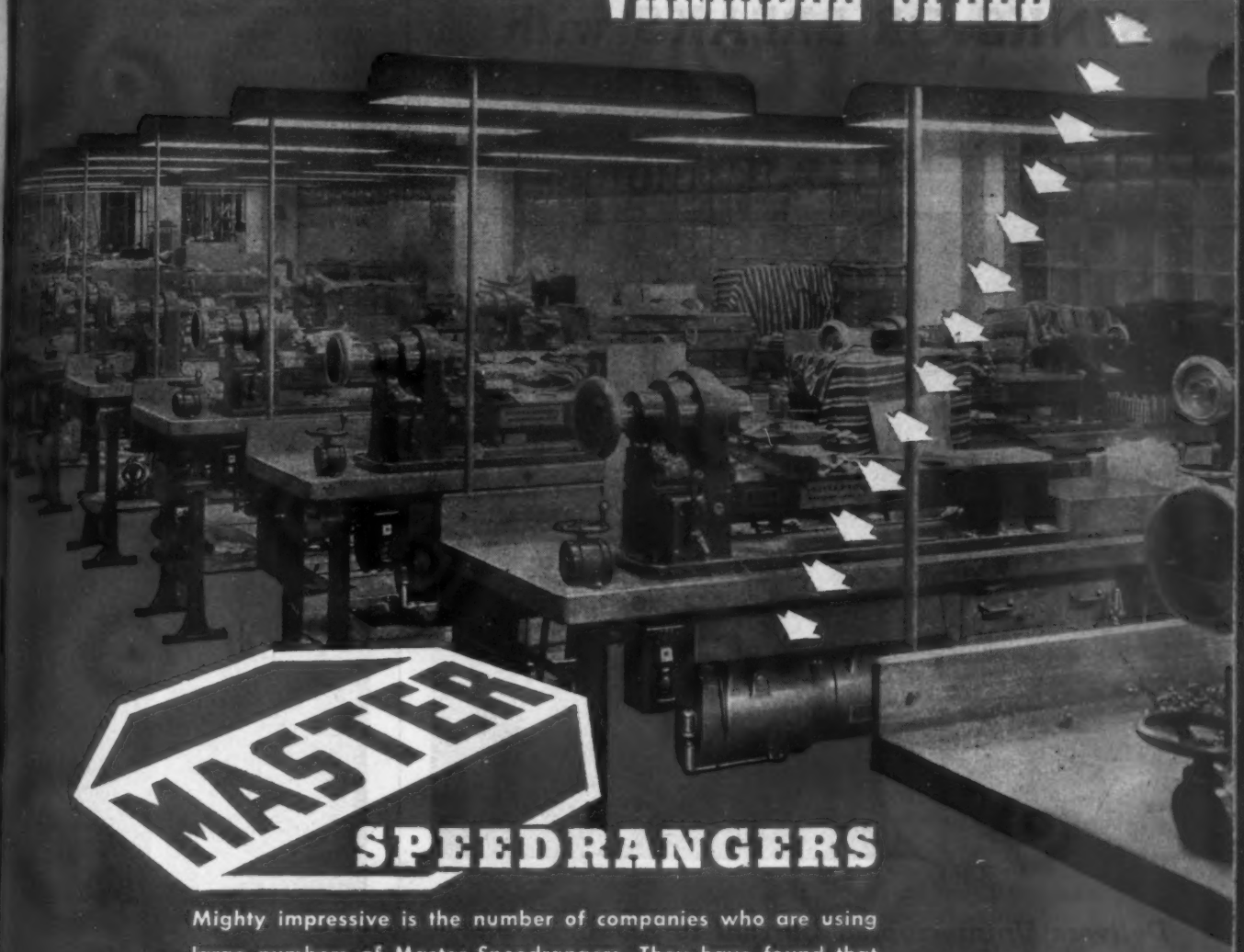
All-plastic goggle is offered for general industrial use. Shatterproof one-piece lens, replaceable at low cost, is said to withstand heavy impact and to be resistant to pitting caused by sparks. Curved frame is designed to fit face snugly but comfortably, and to provide protection from every angle. Frame is reinforced at bridge by high-brass clip, and provided with vent-holes to eliminate fogging. Appearance and light weight are factors for use by women workers. Watchemoket Optical Co., Inc., Providence 3, R. I.

Portable Elevator

Portable hydraulic elevator, that can be quickly set up for operation anywhere inside or outside buildings where ordinary electric power is available, is announced. In collapsed position, it can be towed through any 6x8-ft. opening. It is set up ready for operation by plugging into power socket after the four hinged outriggers have been extended. Unit consists of fabricated steel base, in which are carried the hydraulic oil tank, pumps, motors, and valves; outriggers, which take the weight off the wheels and must be extended before elevator can operate; and telescoping hydraulic



It's easy to secure the advantages of **VARIABLE SPEED** *operation*



MASTER SPEEDRANGERS

Mighty impressive is the number of companies who are using large numbers of Master Speedrangers. They have found that the many advantages of variable speed operation can be secured more easily by using this drive.

It's easier because the Speedranger is a compact integral unit . . . only one unit to mount . . . saves space, saves money.

It's easier because Speedrangers are available for every current specification, every type enclosure, with gearheads, unibrakes . . . and in the whole wide range of types in the Master line. This wide flexibility makes it easier to secure just the right drive for each installation.

And it's easier to keep right on enjoying these advantages because the all-metal construction of the Speedranger insures much longer trouble free service than units in which less durable materials are used. In addition, the complete Speedranger is designed and manufactured as a unit in one plant by one manufacturer, so there is no division of responsibility for its satisfactory operation.

Investigate how easily you can secure the many advantages of variable speed operation if you use Master Speedrangers.

THE MASTER ELECTRIC COMPANY • DAYTON 1, OHIO

Each of the Speedrangers on this installation is supplied for ceiling mounting, and in addition, has provision for manual remote control of the speed.

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THIS AUTOMATIC CABLE TENDER

Delivers Uninterrupted Current to Moving Units

► Wherever electric current must be supplied to moving or portable machinery, Appleton Constant Duty Reelites cut wear and tear on cables to the minimum . . . by keeping them always gently taut. There's no slack. Hence no tangles, breaks or stoppages for repairs. Time of men and machinery, so important under war conditions, is saved; costs are cut.

In various sizes, over 23,000 Constant Duty Reelites are in use on all types of moving electrical machinery from portable hand drills to electric lifting magnets, hoists, air compressors, chargers, motor generator sets and cranes.

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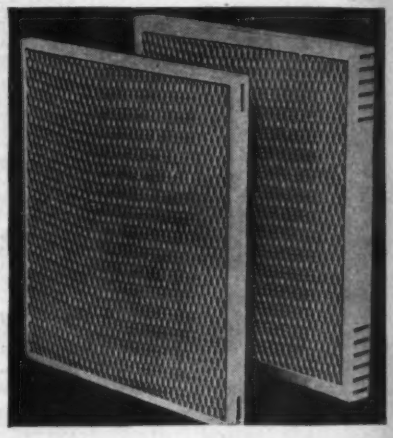
APPLETON

CONDUIT FITTINGS • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

cylinders, on which is mounted a 6-ft. square work platform with guard rails that can be lowered below platform surface for loading purposes. A telescoping ladder enables operator to dismount from any height. Special valve action renders elevator inoperative when overloaded, and three-button switch on platform provides control. Various capacities and lifting heights are available, of which 3000 pounds and 30 feet are typical specifications. Hufford Machine Works, 315 Diamond St., Redondo Beach, Calif.

Air Filters

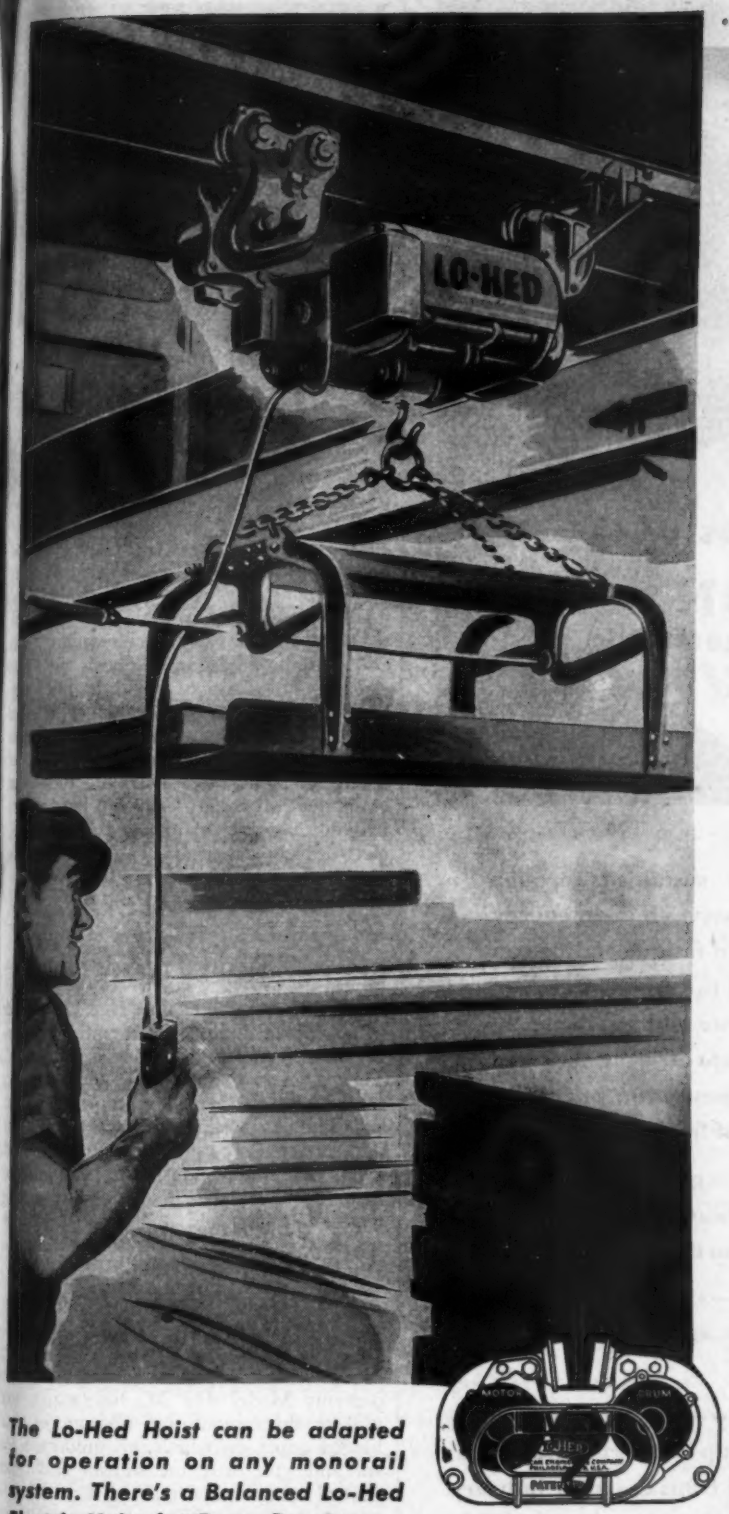
Three impingement-type filters are announced, with an expanded-metal filter mesh design that is said to result in lower initial resistance and high efficiency, even when heavily dust-laden. The filters can be quickly removed, cleaned and recharged, aided by vents in frame that also permit thorough draining. The Badger model, available in 1-in. and 2-in. thicknesses, and in many sizes ranging from 100 to 600



square inches, is designed for ventilation and air conditioning service and other applications where high efficiency, large dust-holding capacity, and low static pressures are required. Arc-welded frames can be provided with handles if desired. The Permo-Aire model, recommended for extra-heavy duty and industrial air cleaning services, is supplied in 2-in. and 4-in. thicknesses with areas from 100 to 1200 square inches. Filtering efficiency is said to be as high as 98.5 percent. The Permo-Aire grease filter, designed for safe kitchen and galley ventilation, is stated to remove grease from kitchen fumes, thereby avoiding danger of grease fires, also protecting mechanical equipment, and insuring better sanitation. Air Devices, Inc., 17 East 42nd St., New York 17.

Remote Control Valve

Designed for cold fluid service, "Flexflo" remote control valve handles water, salt water, chemical solutions, oil, gases, and air. Because it utilizes only one operating part, which is non-metallic, it is said to be extremely resistant to corrosion, erosion, and electrolytic action, and to be automatically self-compensating for wear. Unit features a cylindrical flexible tube of synthetic rubber that fits tightly over a slotted



The Lo-Hed Hoist can be adapted for operation on any monorail system. There's a Balanced Lo-Hed Electric Hoist for Every Purpose.

WHEN IT PAYS TO "GRAB"

The steady, multiple-rope block of the Lo-Hed Hoist simplifies the job

This steel warehouse illustration shows how a standard motor-driven trolley Lo-Hed Electric Hoist glove-fits into the design of a transfer crane. A grab, easily attached to the hook of a Lo-Hed Hoist, permits quick, safe handling of slithering steel sheets.

Applications like this throughout all types of industries show the versatility of Lo-Hed Electric Hoists in moving materials and lowering handling costs.

Easy to operate, sturdy of construction, Lo-Hed gives continuous year 'round performance, with minimum maintenance attention.

There's a Lo-Hed Electric Hoist suitable to save time and money on your operations. Get full information today.

LO-HED IS THE "BALANCED" HOIST FOR HEAVY DUTY SERVICE

The "balanced" arrangement of motor and drum in a Lo-Hed Hoist allows the hook to be pulled up until it almost touches the beam—a desirable plus feature for which you pay no premium. This same arrangement makes possible the use of an all spur gear drive from motor to drum.

Other important features of the Lo-Hed Hoist are the heavy duty hoist motor; strong, short shafts; high duty bearings; 100% positive automatic stop; and removable protective covers for all vital parts.

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2. Champion Service — trained experts in the field to provide prompt assistance on lamp or lighting problems.

3. Champion Economy — the Champion Diamond mark on every lamp is recognized as a symbol of lower light and lamp costs for industry.

4. Champion Availability — through a well qualified industrial supplier near you, equipped to meet your individual needs quickly and economically.

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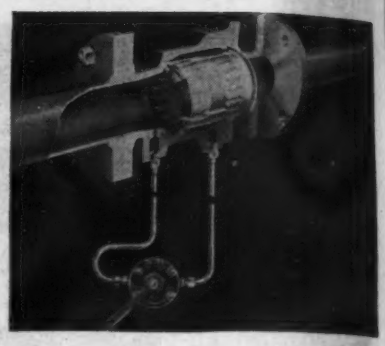
Lynn, Massachusetts
A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO.



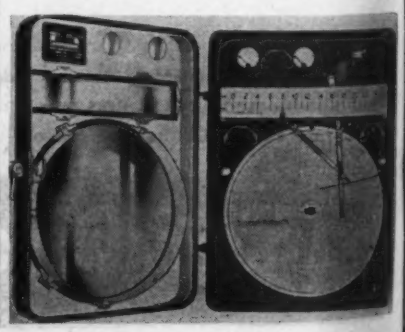
pipe-like core with a solid center barrier, contained in a flanged valve body having one removable flange head. When the auxiliary remote control valve is closed, existing fluid pressure in pipeline forces the flexible tube to expand outwardly against valve body surface, thereby permitting flow of liquid up through slots on inlet side of core barrier and down into slots on the other side to valve outlet. When auxiliary remote control valve is open, unbalanced fluid pressure causes flexible tube to shrink to normal position, thereby sealing slots and stopping fluid flow. Tube is then held tight against leakage by static line pressure. Among several advantages claimed are compactness that requires no more headroom than pipe, and elimination of overhead chains, extensions, and motorized equipment. Auxiliary valve can be operated hydraulically or pneumatically by manual, electro-solenoid, mechanical, or automatic remote control systems. Grove Regulator Co., 6593 Green St., Oakland 8, Calif.

Stair Treads

Dura-Val and Dura-Val De Luxe stair treads, made of an asphalt and felt composition, have recently been announced. They are said to look, feel, and wear like rubber ,and to be waterproof, washable, and durable. Made with corrugated, nonskid surface, they can be cemeted to wood, metal, and concrete surfaces. Standard flat tread is 9x18 inches, and standard nosing treads are 9x18 and 9x24 inches. Extra-size treads can be specially ordered. So-Lo Works, Ins., Loveland, Ohio.

Pyrometer

Model 431 "Pyromaster," which replaces previous Model 440 M, has a universal wall or flush mounting, also an internal hinged panel on which are mounted pen and indicator drive mechanism and other control mechanisms, making it possible to service any part of the instrument without



Free Enterprise At Work

What's Behind the Trade Mark? QUALITY TRADE MARK YOUNGSTOWN SERVICE

THE middle and late '20's were a period of steady growth for The Youngstown Sheet and Tube Company. Following the acquisition of two other steel companies early in 1923, sound policy effected consolidation of the three properties into one strong, unified organization, well diversified in products.

Gradual improvement in general conditions, especially in building construction and the oil industry, permitted Youngstown to prosper. Sales held steady. Selling prices were low, but earnings were good . . . the fruits of farsighted plant improvements and advanced production methods.

It was fortunate, in view of today's tremendous war needs, that freedom of enterprise permitted American manufacturers to earn good profits in the 1920's and to invest those profits in further strengthening themselves. Youngstown's property investment rose from $159,000,000 in 1923 to $223,000,000 in 1929. In those seven years, over $100,000,000 was invested in plant additions and improvements . . . to make steel better, faster. No less important, continuing good earnings permitted the company to dispose of $37,000,000 worth of obsolete, and worn out equipment.

Youngstown has flourished under the system of free enterprise. As a result, it is now in a position to help sustain America in its fight for existence and will serve effectively in meeting the nation's steel needs tomorrow.

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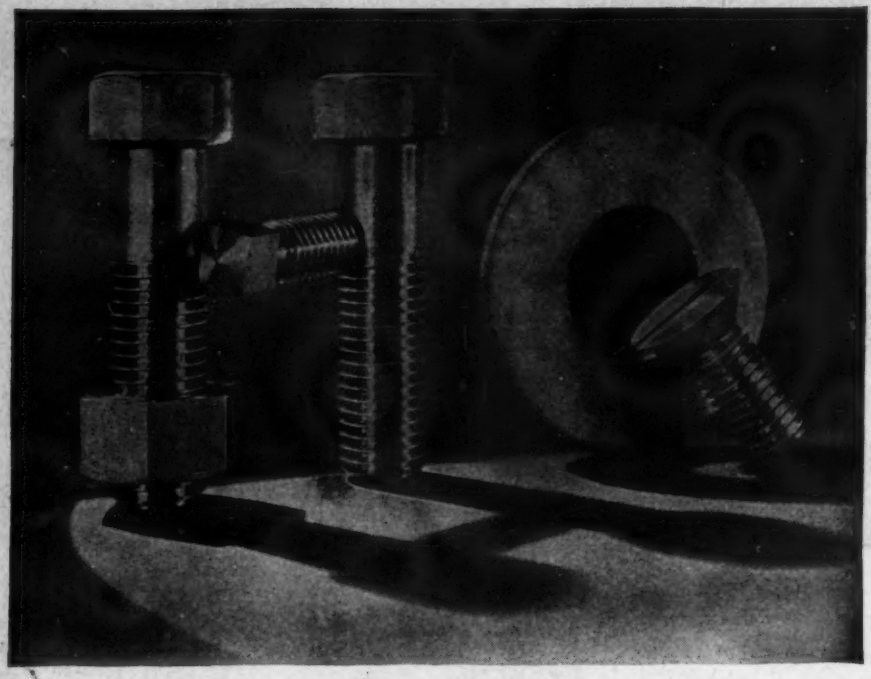

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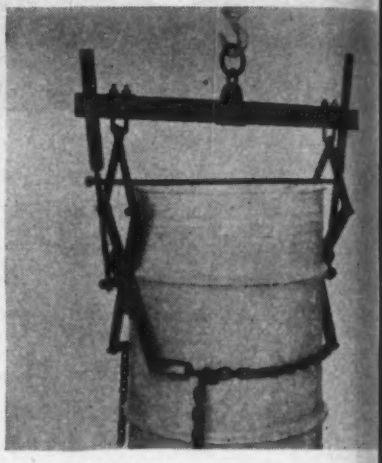
EVERLASTING FASTENINGS

disturbing any other part. Other improvements include a heavy-duty pen-drive motor, a horizontal wide-band indicating scale, a dustproof bakelite housing over stepping relays and potentiometer, and a heavier power supply. The Bristol Co., Waterbury 91, Conn.

Lifting Clamps

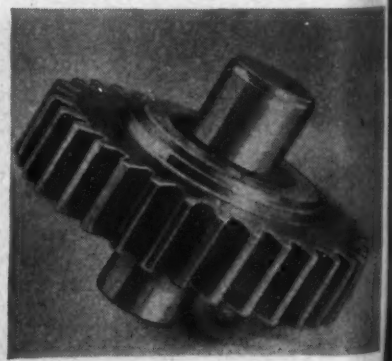
Lifting clamps to handle barrels and drums either horizontally or vertically have recently been announced. The vertical lifter No. B-1, is lowered over the barrel, and the two encircling chains are placed in grab hooks. The lifter automatically opens when the lower crossbar touches the top of the

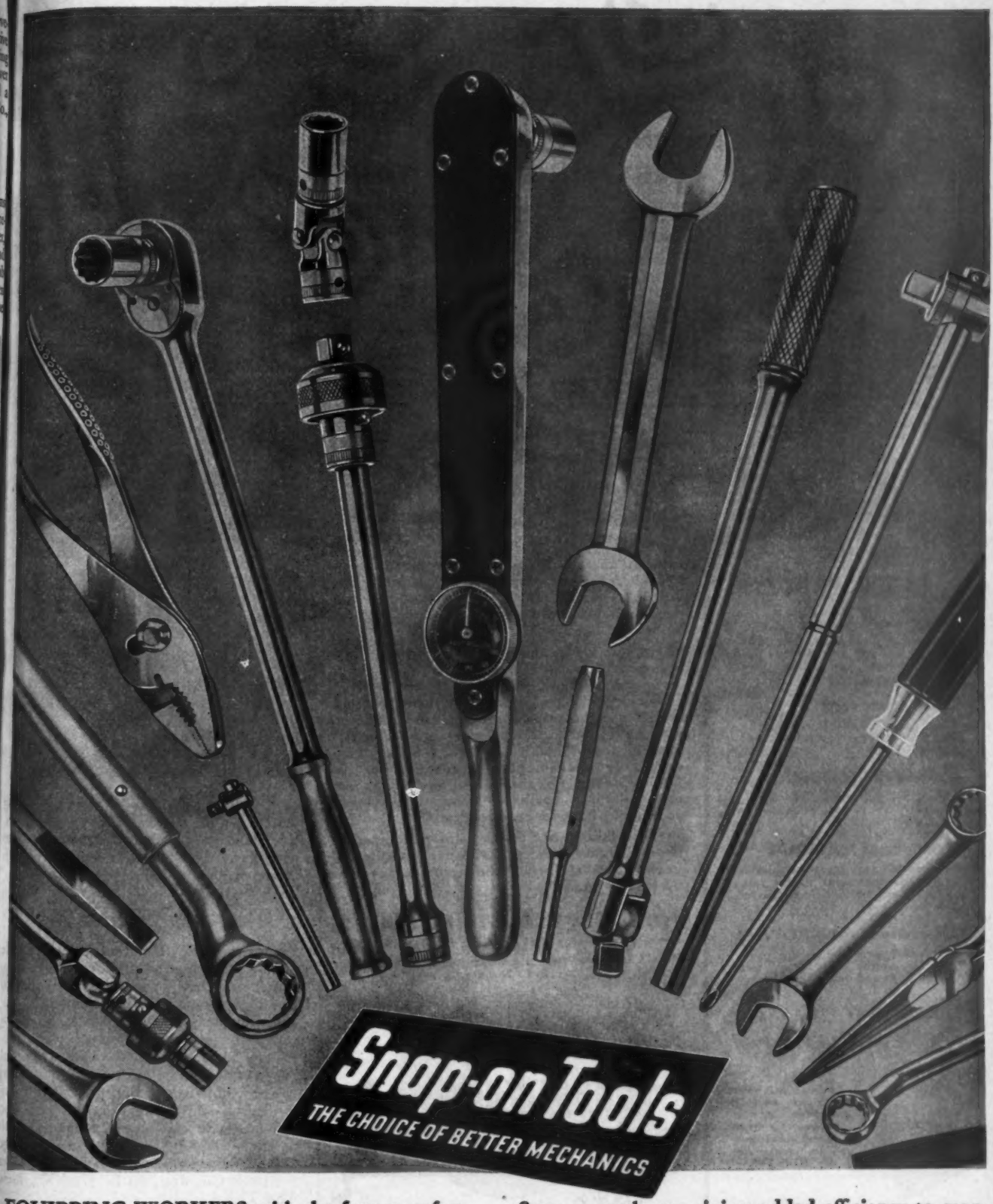


drum. Adjustment for various container diameters is by quick manual change of chains in grab hooks. The horizontal lifter No. B-2, is constructed on the ice-tong principle, with curved plates that grab the drum and hold it tightly in position. Both models are available in standard capacity of 1200 pounds, and special sizes to order. Never-Slip Safety Clamp Co., 827 Mamaroneck Ave., Mamaroneck, N .Y.

Synthetic Rubber Pinion Gear Bushing

Insulation of pinion gears from shafting by application of a rubber bushing between them is stated to stop transmission of noise, shock, vibration, and impact. Process involves insertion of rubber or synthetic bushing without any special tooling, and does not require usual inner and outer metal sleeves for insertion. No special preparation of shafting or gear is needed, and milling of keyways or flats is elim-





EQUIPPING WORKERS with the fastest, safest, most accurate tool *for every hand tool operation* inevitably results in better, faster workmanship. Tools poorly adapted to each specific application waste time, skill, energy. Everywhere in industry, Snap-on tools are giving added efficiency to manpower in production, assembly and maintenance operations. Snap-on's direct-to-user tool service is available through 35 factory branches located in key production centers.

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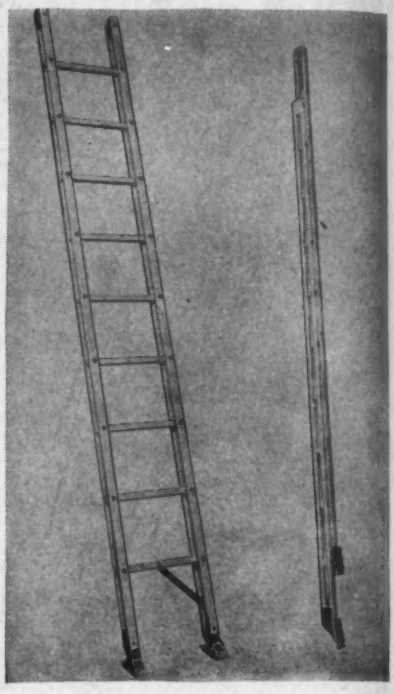
INDIANAPOLIS 548 Massachusetts Ave. Riley 2534
LOS ANGELES 2027 S. Figueroa St. Prospect 6011
MILWAUKEE 104 East Mason St. Daly 2949
MINNEAPOLIS 2 Foshay Tower Atlantic 7363
NEW HAVEN (Hamden, Conn.) 1240 Whitney Ave. Phone 2-5885
NEW YORK 92 Warren St. Worth 2-3352
OMAHA 1107 Farnam St. Atlantic 5540
PHILADELPHIA (Bala-Cynwyd, Pa.) 349 Montgomery Ave. Greenwood 4477
PITTSBURGH 5339 Penn Ave. Highland 9900
ST. LOUIS 1706 Olive St Central 0153
SAN FRANCISCO 70 Tenth St. Underhill 1212
SEATTLE 1915 First Ave., S. Main 0919

nated. No heat is required for process. After bushing is applied, the resultant mechanical bond with bore of gear and surface of shaft is said to be of sufficient strength to transmit required torque. Bushings, Inc., 3442 W. Eleven Mile Road, Berkley, Mich.

Folding Safety Ladder

Safety ladder that folds together to a 3x3-in. bundle is easy to handle. Compact and light in weight, ladder is said to be capable of withstanding hard usage. It is kept



rigid in open position by special locking device. Ladder feet are provided with Duo-Safety shoes for working safely on all types of surfaces. Duo-Safety Ladder Corp., 9th at Soo R.R., Oshkosh, Wis.

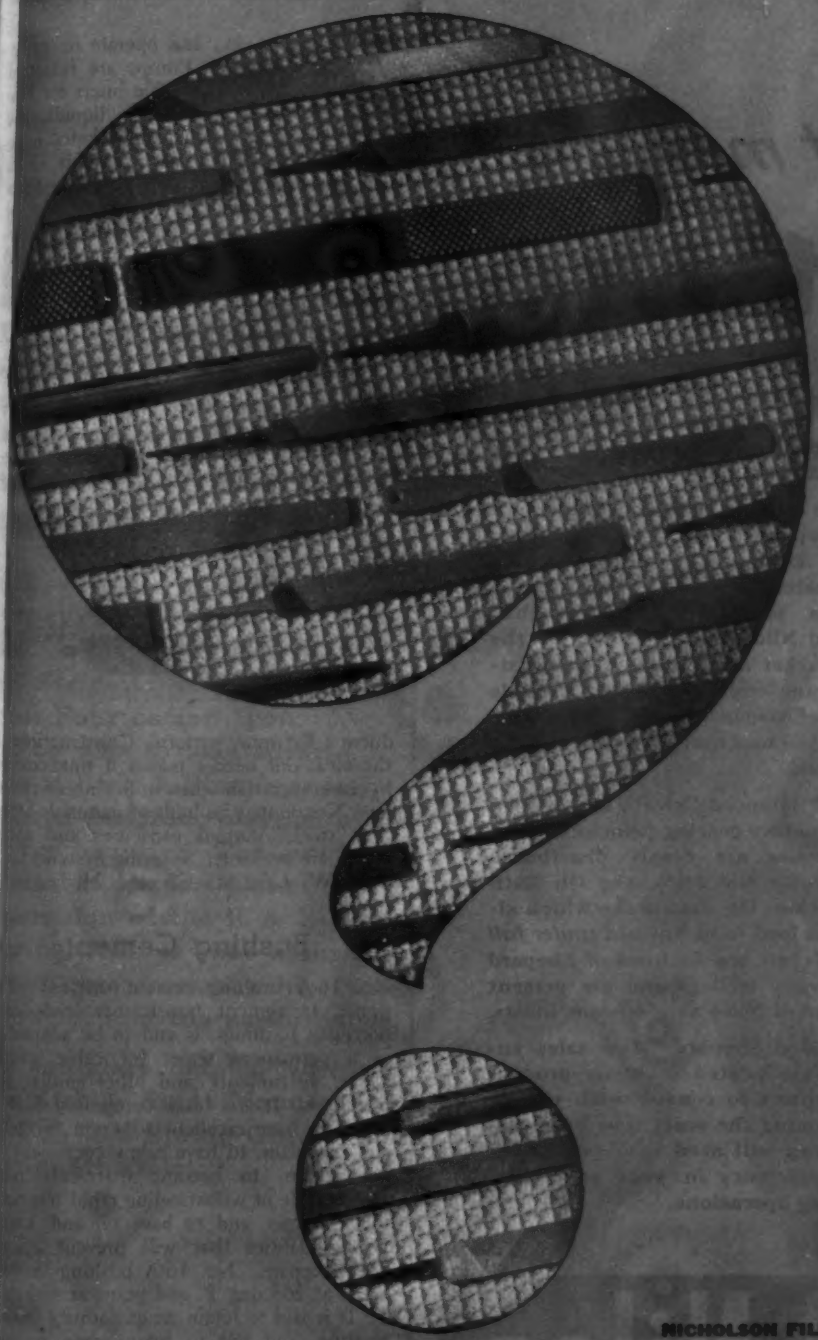
Arc Welder

Bumblebee a.c. welders are now available in all-weather models of 300- and 500-amp. capacities. They are similar to the standard Bumblebee models, except for added features of the moisture-proof insulation of electrical parts, moisture-proof paint protection on all parts, and weather-resistant enamel finish on outer case, which also has gaskets and louvers designed to prevent entrance of rain. These models are also equipped with low-voltage contactors which automatically hold the open circuit voltage at approximately 40 volts. Wilson Welder & Metals Co., Inc., 60 E. 42nd St., New York 17.

Twin Pumping Unit

Twin pumping unit, developed primarily for use in petroleum bulk and blending plants, is said to have many other applications in industrial fields where extra peak capacity is needed, or two different liquids are desired to be simultaneously handled without contamination. Pumps are 90 g.p.m. capacity each for pressures up to

"SELECTIVE SERVICE"



Time was when a file was simply "a many-toothed implement for abrading the surface or edges of metals and other materials." From it grew a limited range of shapes and sizes, with selection of cuts confined principally to "single," "double" and "rasp" cuts of varying degrees of coarseness.

For a large percentage of jobs the mechanic used whatever approximate file happened to be at hand. Since then industrial progress has ranged far and moved swiftly. As "time and work studies" began to raise shop efficiencies, file engineering advanced with equal speed.

Today, with Nicholson setting the pace, files and filing techniques are highly specialized. Research and experiment have produced literally thousands of kinds, cuts and sizes—each designed for some particular type of material and operation . . . for doing work better, quicker, more economically.

Oddly enough, it is in their minuter details—the teeth—that file distinctions have their greatest bearing on the work to be done and the results to be achieved. Height, thickness, spacing, angle, hardness, type of edge, relative depth of overcut and upcut—all make for countless combinations and characteristics.

Choosing The right file for the job is a form of "selective service" that is highly important in efficient industrial production. It can mean untold savings in man-hours, faulty work, and in the serviceable life of the files themselves.

Nicholson's 80 years' experience in file designing and manufacture has accumulated a vast fund of information that is open to any file-using organization.

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the widely recognized 48-page Nicholson book, affords production and purchasing heads, foremen and mechanics, much elementary and considerable advanced information on the kinds, use and care of files—including discourses on many special-purpose files for the newer metals and alloys. How many copies do you need for judicious distribution in your establishment?

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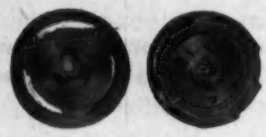
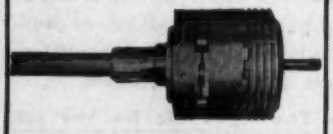


PLANETARY GEARING



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106 pages—amply illustrated with sectional views and line drawings. Describes maintenance of entire line of Shepard Niles Electric Cranes & Hoists.

Ever look inside a Shepard Niles hoist? If you did, you would find exactly the same construction as used on a Shepard Niles crane trolley.

While a single beam hoist is seldom called upon to lift the heavy loads that a crane trolley must handle, nevertheless, the service very often is just as severe. Recognizing this, Shepard Niles simply eliminated the axle bracket arms of their Shepard-type crane trolley, provided suitable means of suspension, and a hoist, capable of the toughest kind of going was the result.

The "Balanced Drive", based upon the planetary gearing principle where all stresses are evenly distributed throughout the drive; the Oil Bath lubrication; the load brake which allows the load to be lowered *under full control*—all are features of Shepard Niles crane trolleys and are present in Shepard Niles single beam hoists.

Qualified Shepard Niles sales engineers are located in all war-production centers to consult with you in determining the exact type of equipment you will need to obtain maximum efficiency in your materials-handling operations.

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CRANE & HOIST CORPORATION

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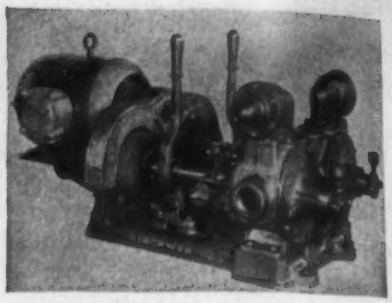
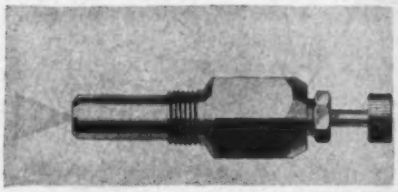


100 lb. per sq. in., and operate on swinging vane principle. Pumps are furnished unlined, or with removable liners for handling corrosive or abrasive liquids, and can be furnished with steam-jacketed heads for pumping highly viscous liquids. Both pumps are mounted on a single cast-iron base, and are driven, singly or together, by individual clutch control, through a reduction gearing powered by one 1800 r.p.m. integrally mounted motor. Blackmer Pump Co., Grand Rapids 9, Mich.

Lubricating Nozzle

Lubricating nozzle for lubricating heavy gears or in chemical spray processes, and similar types of service, uses a special long-wearing, hardened steel orifice, and produces a flat spray pattern. Construction of the clean-out needle makes it unnecessary to cease operation when orifice needs cleaning. Nozzle may be built of materials other than steel. Various capacities and spray angles are available. Spraying Systems Co., 4021 W. Lake St., Chicago 24.



Bushing Cement

No. 16-A bushing cement originally designed to cement transformer leads into porcelain bushings, is said to be adaptable as a permanent sealer for cable joints, boxes, instruments ,and other similar applications. It is a black compound that is stated to have excellent adhesion to metal and porcelain, to have a low coefficient of contraction, to become extremely hard and capable of withstanding rapid temperature changes, and to have oil and waterproof qualities that will prevent oil or water seepage. No. 16-A bushing cement melts at 265 deg. F. and pours at 400 deg. F. It is said to retain its uniformity during melting, and not to foam when heated. John C. Dolph Co., Dept. 32, 168 Emmett St., Newark 5, N. J.

Portable Air Compressor

Wheelbarrow-type air compressor, weighing 225 pounds, is designed for use at indoor and outdoor locations inaccessible to stationary or truck-mounted units. It in-

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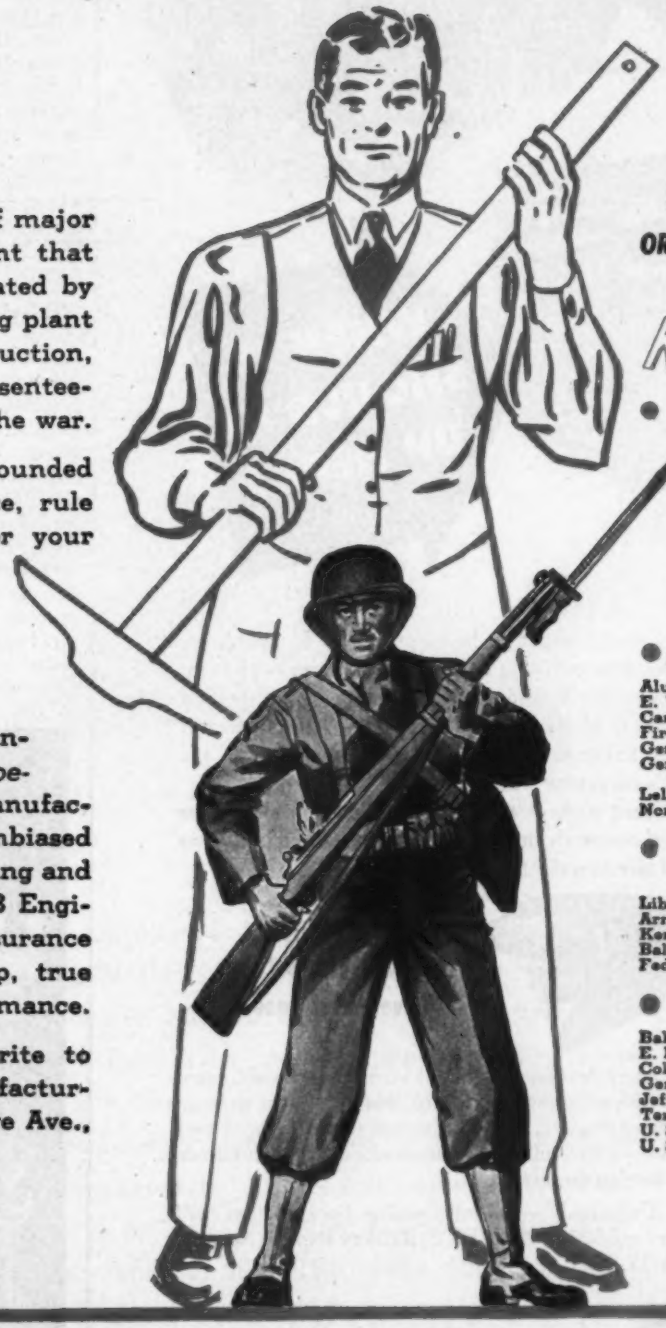

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For complete details, write to The Kirk & Blum Manufacturing Co., 2835 Spring Grove Ave., Cincinnati, Ohio.

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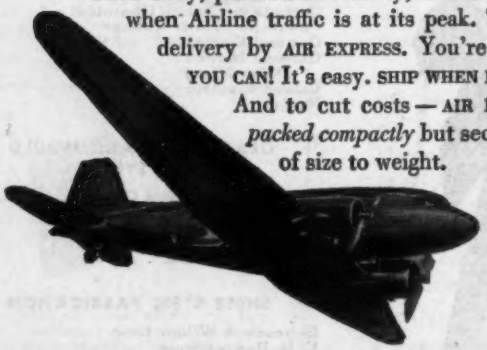

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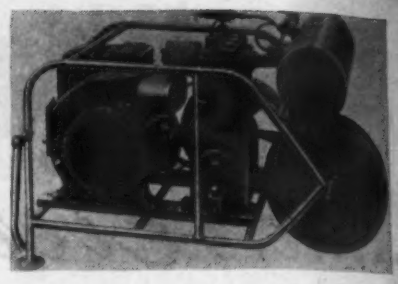

corporates a single-stage, air-cooled, Model 216 Quincy compressor, operating at 1250 r.p.m., that is said to deliver in excess of 16 cu. ft. per min. at 80-lb. pressure. A special hand crank provides a belt tension adjustment to release compressor load for easier starting in cold weather. All-metal frame is constructed of welded tubular steel, has a mud- and waterproof steel front wheel, and hinged handles that are dropped down when not in use. Quincy Compressor Co., 304 Main St., Quincy, Ill.

Tank Gage and Sampler

Hand tank gage, called Gaugit, measures liquid levels and takes samples and temperatures at the same time, without loss of valuable vapors or exposing the operator to fumes. Unit consists of an upper chamber containing the gaging tape, and a lower chamber containing a sampler-bob with thermometer. Each has a separate access door. Base of unit is a standard 125-lb. drilled flange for mounting on a standard 4-in. gate valve. In gaging, gate valve is opened, and sampler-bob is lowered, keeping both access doors closed, until estimated level of liquid on tape comes into view in the sight glass on top of unit. A

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Here is the Subtractor of Materials Handling Costs

CM Bulletin 142 illustrates and describes every operating feature that makes the CM Meteor Heavy Duty Electric Hoist an outstanding production time-saver . . . cutting deep into materials handling costs. Helical gears, aeroplane cooling, low headroom, safety limit brake, simplified maintenance . . . these and other advantages are explained in terms of operating efficiency and service life. Various types trolleys and accessory equipment, lift and speed tables, dimensions, etc., are included.

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Capacities from ½ ton and up. Lifting speeds from 18 to 60 feet per minute . . . Low headroom. Hook suspension, plain, geared or motor driven trolley.

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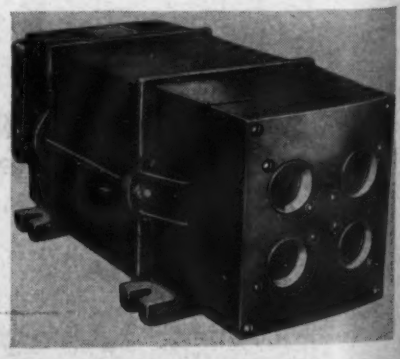
gaging valve, operated with a knurled knob, is then closed to isolate the upper from the lower chamber. Tape access door is then opened, gaging paste is applied to a section of tape. After closing access door and opening gaging valve, tape is again reeled out slowly until sampler-bob meets tank bottom. By proper manipulation of the gaging and gate valves and access doors during reeling in of tape, the level reading can be taken, tape can be cleaned of paste, and sampler-bob can be emptied and temperatures recorded, without appreciable loss of tank vapors. The Johnston & Jennings Co., 877 Addison Rd., Cleveland 14.

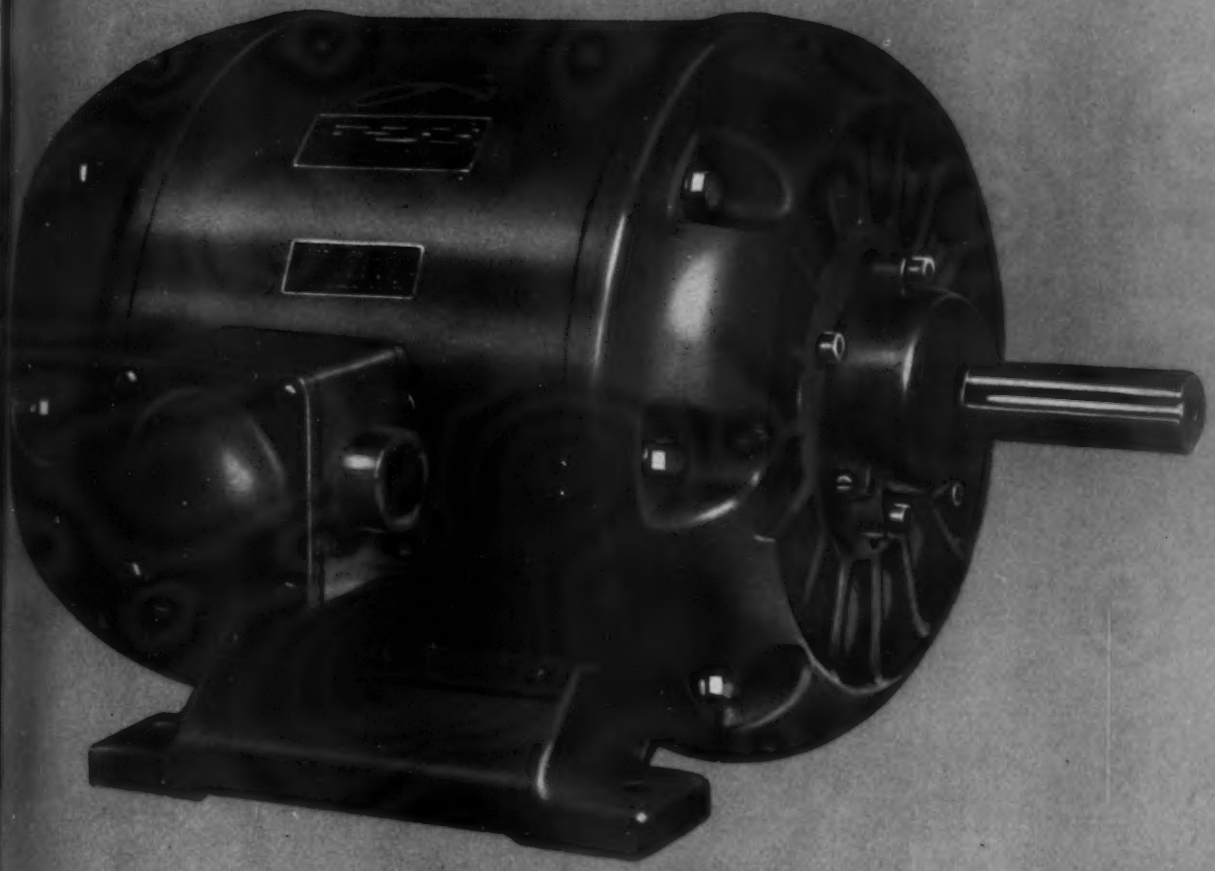
Welding Helmet

Welding helmet with a lift-front lens holder that may be used in a semi-open position is said to afford the operator a clear view of work while protecting him from harmful flashes. Holder may also be opened a full 90 degrees in the conventional manner. Reduction in spring tension is said to give not only smooth, effortless operation of the door, but also to eliminate the "shock" and noise. Inter-meshing beaded surfaces are claimed to assure a positive "blacking-out" of light rays, and simplified lens springs facilitate lens changing. Chicago Eye Shield Co., 2331 Warren Blvd., Chicago 12 .

Portable Transformer

Portable transformer is designed to furnish 110-volt current source for emergency use for inspection lights or small portable tools. Unit is 1 kva. capacity, air-cooled, and can be supplied for either 220- or 440-volt





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Your Electric Motor Requirements

The day of trying to use a standard motor for a special job is about over.

Machinery designers, and production managers have learned that it is much more efficient and economical to obtain a motor with exactly the electrical and mechanical characteristics required to perform a specific job than it is to try to doctor up a standard "shelf" motor to do the job.

Speed and horsepower are no longer the major measuring stick of motor requirements—they are merely incidental to the many other characteristics available in electric motors today.

For over forty years we have been developing special motors for special jobs—our engineering department has a wealth of experience along this line—

* * *

Our engineering development department has created many outstanding — perhaps revolutionary — improvements in electric motor design, construction and performance that are now playing an important role in helping win this war.

Many of these important new motor developments will also play an important role in the post-war period.

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primary, with dual fused secondaries of 110 volts each. Transformer is carried and connected to power line where needed, and re-fusing can be done on spot without inspecting main switchboard. The Acme Electric & Mfg. Co., Cuba, N. Y.

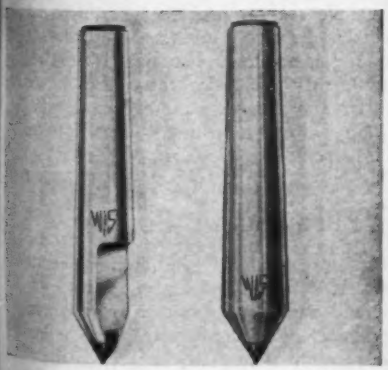
Water Cooler

Self-contained electric water cooler, for restaurant and cafeteria use, is equipped with two push-down glass fillers to facilitate quick service. Capacity is said to be 18 gallons per hour. Cabinet has removable

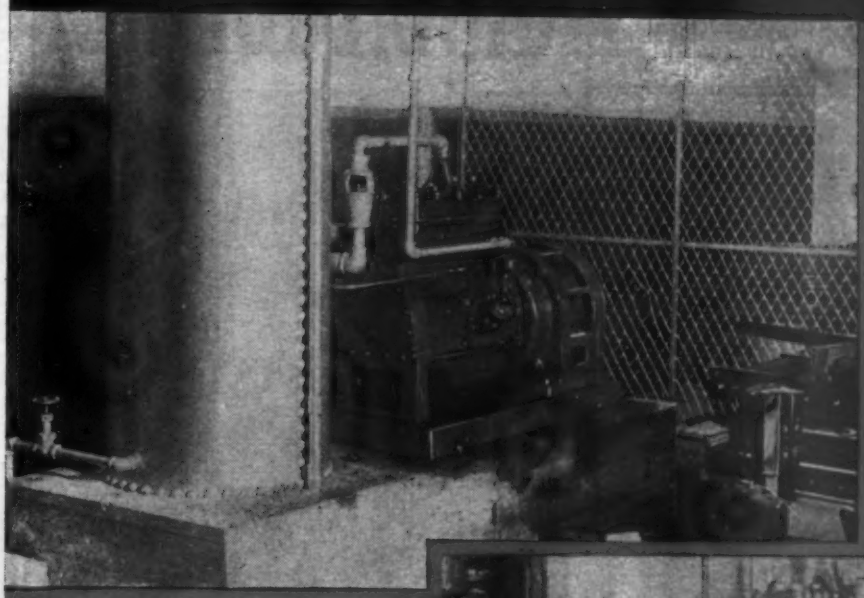
panels for easy access to refrigerating mechanism located in base, and is finished in neutral gunmetal. Sanitation and elimination of water contamination are stressed in design features, including white porcelain-enameled top, and rat-proof cabinet construction. Cordley & Hayes, 443 Fourth Ave., New York.

Lathe Centers

Longer service life is said to be achieved in the Wendt-Sonis lathe centers and half centers by the extension of the carbide insert into the shank of the tool. This ex-



Schramm Air Compressors



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The rugged construction of Schramm's water cooled stationary air compressors gives them perfect balance — frees them of vibration and enables you to get air for any type industrial job.

Pictured here are three Schramm installations—each adapted to a different type job. This is only a small sample of their versatility, as they are installed in hundreds of plants throughout the country.

Schramm advantages: easily bolted directly to any substantial floor . . . compact to reduce headroom and floor space requirements . . . 100% water cooled to provide top efficiency both winter and summer.

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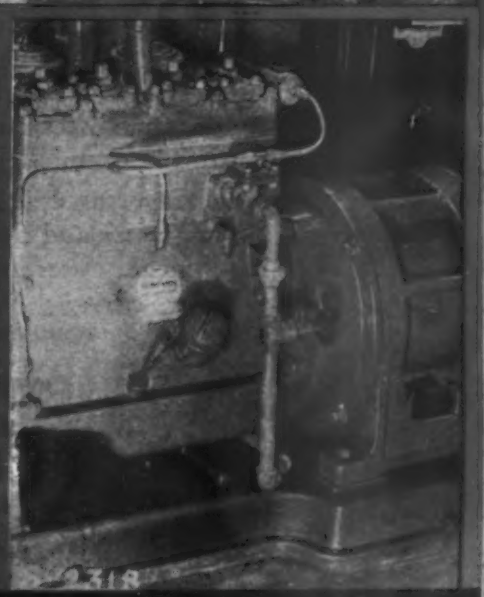

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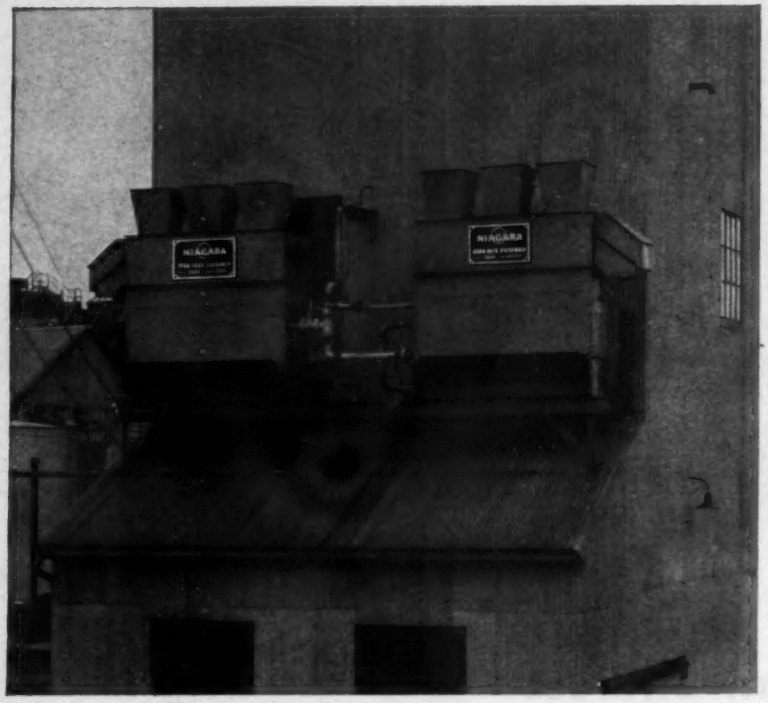

● Wherever there is a need for the use of cooling water or the cooling of any liquid to exact temperatures, the NIAGARA *AERO* HEAT EXCHANGER provides a more accurate control and lower costs for cooling. Refrigeration is not needed.

These results are advantageous in all types of water-jacketted and water-cooled equipment; for example, they have solved for many the troubles coming from excess water and oil in air compressor lines. Other uses include the cooling of diesel engines and hydraulic equipment; also chemicals and intermediates requiring cooling or controlling temperatures in chemical processes.

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tension is approximately equal to the exposed portion of the tip, allowing extra regrinds before need of replacement, should the bearing surface of the tip become damaged. Because of special precision manufacture these lathe centers are guaranteed by manufacturer to a concentricity within 0.0002 or less, thus permitting finish grinding and turning to closer tolerance. They are claimed to hold this accuracy for a long time, because of the wear resistance of the carbide tip. Available in standard tapers. Wendt-Sonis Co., Hannibal, Mo.

Lift Truck

The Hyster "20" lift truck, of 2000-lb. capacity, is intended for use in narrow aisles and crowded quarters. Its pneumatic tires are said to increase operating speed, permit faster starting and stopping, smooth

travel over rough ground or floor obstructions, and give better traction for going up ramps. Gasoline-powered, fork-type, unit has a 25-h.p., 4-cyl., V-type motor equipped with spark arresting mufflers. The 66-in. turning radius, made possible by the design of combined counterweight and trunnion wheel, is said to provide a high degree of maneuverability. Lift truck has a wheel base of 45 inches, with an over-all length, not including load arms, of 71 inches, and an over-all width of 36 inches. Willamette Hyster Co., Portland 8, Ore.

Motor Insulation

Used for coating stator field coils on electric motors, Insl-X, is said to provide a tough, hard coating that is impervious to moisture, acids, or alkalis, and that will not chip or crack. By its use, the taping of coils after winding is stated to be unnecessary, and only the corners need to be secured tightly. The contracting tendencies of Insl-X, when drying, are said to provide a sealing coat that holds the wire as in a vise, and prevents vibration or shifting. Pre-shaped coils require quality No. 33; where shaping is done after insulation, a more flexible quality, No. 11-6, is required. Insl-X Co., 857 Meeker Ave., Brooklyn, N. Y.

Fluorescent Fixture

Fluorescent fixture, using four 40-watt lamps, is designed for drafing rooms, offices, and work areas. It can be mounted individually or in continuous rows, either in suspension or flush to surface. Installa-

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Curled-Chip Teeth

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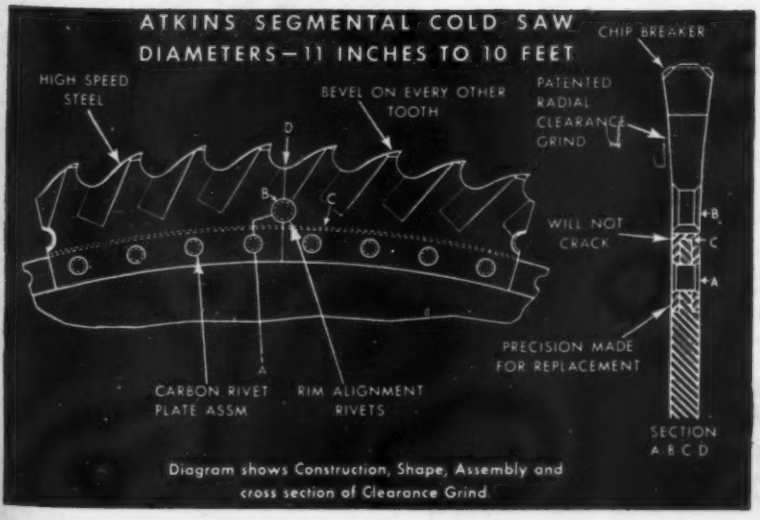

Diagram shows Construction, Shape, Assembly and cross section of Clearance Grind

● For heavy-duty sawing—for ingot cropping, billet sawing, bar cut-off, and other metal cutting jobs that "kill" ordinary saws—Atkins Curled-Chip Tooth design has been adapted to segmental saws. Shown is an Atkins segment, as it appears before fastening to the blade. The extra advantages of this type of segments are (1) A standard cutting width consistently narrower than other types of inserted tooth saws, (2) Economy—worn-out teeth are easily, quickly replaced without discarding the saw discs, and (3) Great resistance to the shock of heavy duty work. These, plus the fast cutting, heavy feed rates and accurate cuts assured by Curled-Chip Teeth, make Atkins Segmental Saws your best bet for your toughest jobs. Write for *Atkins Curled-Chip Manual* for full details.

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In two ways, the lead-alloy coating on Continental's new Lead-Sealed steel sheets contributes to better forming. First, Lead-Sealed sheets have a remarkably uniform temper so desirable for accurate forming. The fact that the lead-alloy coating is applied to the base metal at comparatively low temperatures helps make this possible. Second, the coating is softer and more ductile . . . It serves as an effective lubricant in die-forming to cut rejects and speed production. A controller box cover pressed from Lead-Sealed is pictured at right. The severe deformations indicated failed to expose the base metal.

To manufacturers, Lead-Sealed offers many advantages. Durability, paintability, solderability, formability—all contribute to Lead-Sealed's growing popularity on the production line.

CONTINENTAL STEEL CORP., KOKOMO, IND.

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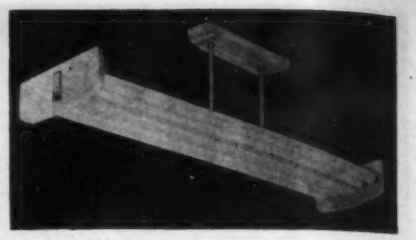


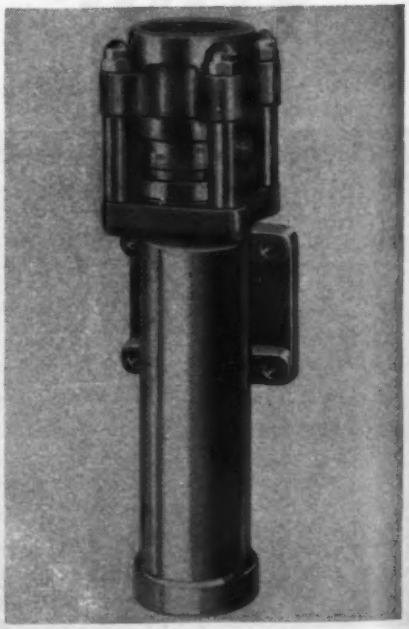
tion time is said to be less because of method of hanging, involving metal "tracks" that are fastened to ceiling with toggle bolts or anchors. Fixture is then slid into place on tracks. Wireway channel and end pieces are all metal, finished in durable white enamel. Unit comes completely wired, ready for hanging, with standard Tulamp ballasts, starters, and sockets. Power factor is said to be over 90 percent. Length of unit is 49 inches, width 12¾ inches, and height 5½ inches. Operating voltage is 110-120 volts, 60 cycle a.c. Higher voltages can be obtained. Mitchell Mfg. Co., 2525 Clybourn Ave., Chicago 14.

Strap Wrench

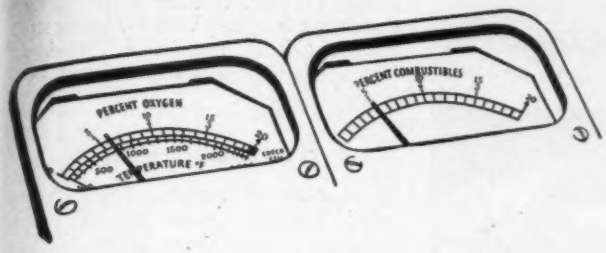
"Ridgid" strap wrench is intended for better handling and protection of polished nickel and chrome pipe and tubing. It is said to be easy to attach and use, and to have positive grip. Strong I-beam handle and solid head are in one piece, with special webbing strap that can be removed for replacement by pushing out pin held by spring clips. Available in two sizes: No. 2, capacity ⅛ to 2 inches, 17-in. strap; No. 5, 1 to 5 inches, 30 in. strap. The Ridge Tool Co., Elyria, Ohio.

Fluid Flow Gage

Precision flow gage, called Hy-Mac Flogage, continuously indicates the rate of fluid flow, has no restrictions or orifices, permits actuation of the indicating dial by the kinetic energy of the fluid flowing through the gage. It is said to be insensitive to changes in fluid viscosity, fluid

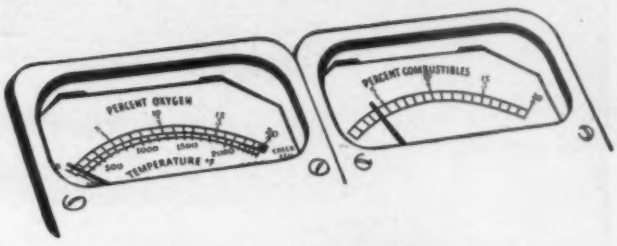


How to Control Furnace Atmosphere



Make this Test

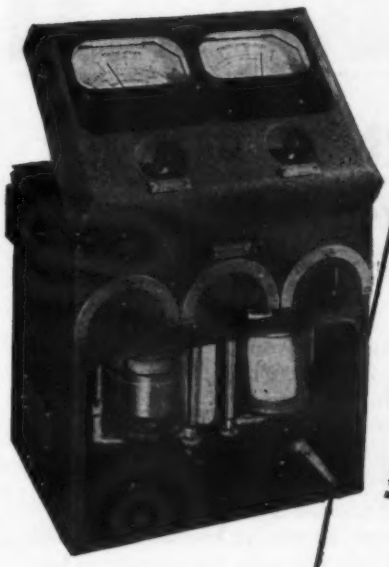
Have a Cities Service Engineer, with the aid of the Industrial Heat Prover, take a test reading* of any combustion equipment in your plant. Note percentage of needless excess oxygen in the furnace atmosphere as registered on the Heat Prover dials.

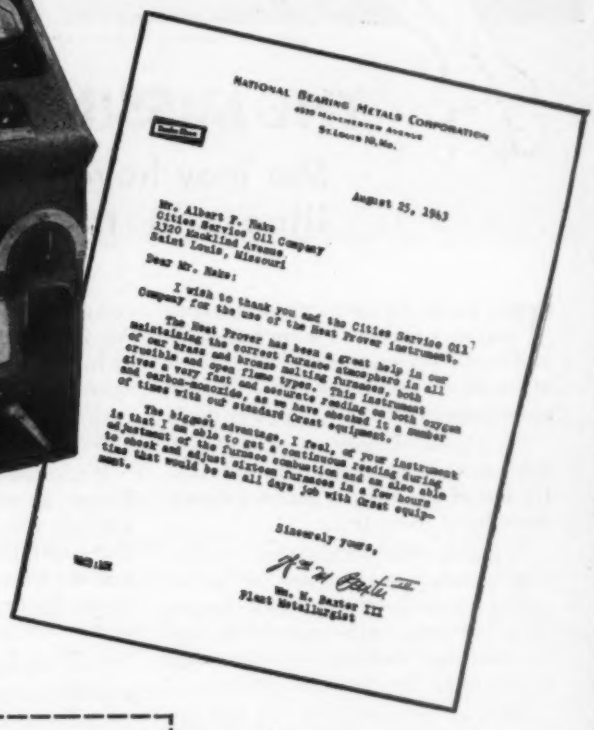


See the Results

The Cities Service Engineer may then evaluate the Heat Prover analysis against his data and curve charts which are the Standard of Efficiency for the particular equipment . . . and make recommendations for correcting the defect—which in this case would reduce excess oxygen to ½%.

THE CITIES SERVICE HEAT PROVER reveals the degree of waste caused by air deficiency (excess fuel), or the degree of waste caused by dilution (excess air). Through unique means these conditions are measured directly on the two Heat Prover dials . . . one indicates the percentage of unused combustibles, and the other the percentage of excess oxygen which may be present in the spent gases. These readings are continuous and can be made at any instant from combustion samples taken from any part of the furnace, pit or crucible atmospheres.





NATIONAL BEARING METALS CORPORATION
4920 Manchester Avenue
St. Louis 10, Mo.

August 25, 1943

Mr. Albert F. Hahs
Cities Service Oil Company
1320 Mansfield Arcade
Saint Louis, Missouri

Dear Mr. Hahs:

I wish to thank you and the Cities Service Oil Company for the use of the Heat Prover instrument.

The Heat Prover has been a great help in our maintaining the correct furnace atmosphere in all of our brass and bronze melting furnaces, both crucible and open flame types. This instrument gives a very fast and accurate reading on both oxygen and carbon-monoxide, as we have checked it a number of times with our Standard Orsat equipment.

The biggest advantage, I feel, of your instrument is that I am able to get a continuous reading during adjustment of the furnace combustion and am also able to check and adjust sixteen furnaces in a few hours time that would be an all days job with Orsat equipment.

Sincerely yours,

Wm. W. Baxter III
Plant Metallurgist

*Mail this Coupon

TODAY FOR AN INDUSTRIAL HEAT PROVER TEST OF YOUR EQUIPMENT—AT NO COST OR OBLIGATION TO YOU.

CITIES SERVICE OIL CO.
Room 152
Sixty Wall Tower
New York 5, New York

Gentlemen: Please contact me regarding your Industrial Heat Prover Test.

Name_____

Title_____

Company_____

City_____

(Available only in Cities Service Marketing Territory East of the Rocky Mountains.)

CITIES SERVICE OILS
ONCE-ALWAYS

CITIES SERVICE OIL COMPANY
ARKANSAS FUEL OIL COMPANY

Trade Marks "ScotTissue," "Soft-Tuff," "Washroom Advisory Service" Reg. U. S. Pat. Off.

THE MISSING "MAN"

She may have "caught" her illness in the washroom

THE PROBLEM OF ILLNESS absences becomes graver as more and more millions of women enter industry. Such absences are *60 per cent more frequent* among women than among men workers.

Half these illnesses are traceable to colds and their complications. But contagions of this sort, experience shows, are subject to control.

A mighty effective measure is to provide sanitary washrooms, with hot water, soap and individual tissue towels. Men and women appreciate them, and the thorough washing they encourage cleans away the germs of illness.

Have an architect help you plan up-to-date washrooms. Make them "health zones" for men and women alike.

The Scott Washroom Advisory Service shows how to make ScotTissue Towels go farther

For a complete check-up on your washroom facilities, call on the Scott Washroom Advisory Service. It may be able to suggest several helpful improvements and economies.

If you use ScotTissue Towels, it will help you make your supply go farther—and that's important. For the war has brought tremendous new demands for Scott products . . . demands that production facilities cannot meet.

The only solution is careful use of the available supplies. For instance, our educational material reminds workers that *one* "Soft-Tuff" ScotTissue Towel dries completely . . . will, in fact, absorb twice the water left on hands. And it has ten times the rub strength of previous ScotTissue Towels, though soft as ever.

Scott Paper Co., Chester, Pa.

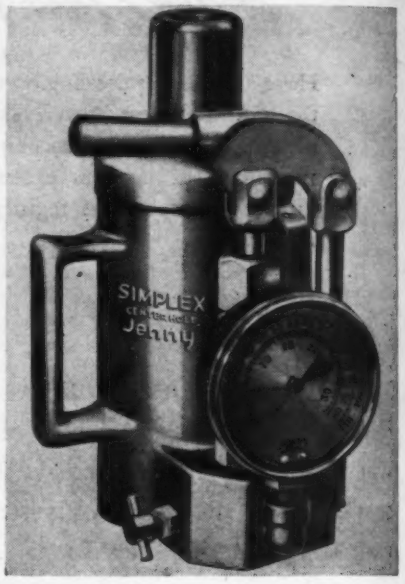
SCOTTISSUE TOWELS

STAY TOUGH WHEN WET

temperature, or fluid pressure, to be accurate to within a fraction of 1 percent, and to be adaptable in design to any desired capacity. An adjustment permits measurement of the flow rate for fluids of different specific gravities. Top and bottom fittings of gage, together with a bracket that is cast integrally with the center structure, facilitate installation. Hydraulic Machinery, Inc., 12825 Ford Road, Dearborn, Mich.

Hydraulic Puller

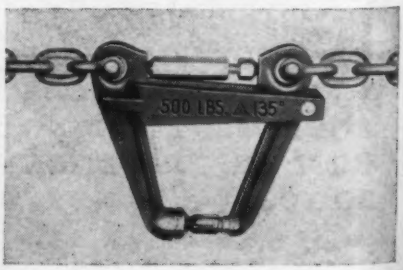
Applications of Simplex Jenny "center hole" hydraulic puller include pulling bushings, cylinder liners, cutless bearings, pistons, wrist pins, valve seats, keys, wheels, sprockets, gears, boiler tubes, and pipes.



It is also used to pull structural members together for welding or riveting. It also pushes or lifts; and can be rigged up as a portable press. It operates vertically or horizontally without the need for heavy auxiliary equipment, and without side thrust or friction, the manufacturer states. The Jenny is its own back-up and is self-supporting because of its center hole construction. Five models are available, 30- to 100-ton capacity. Unit is built of heat-treated alloy steels to withstand heavy loads and service abuse. Templeton, Kenly & Co., 1020 S. Central Ave., Chicago 44.

Fire Release Link

Release link of 500-lb. capacity is available as a heat-operated fire-protection device where positive, self-releasing action may be required for use with heavy loads. It is of the Quartzoid bulb type, which is said to



PREWAR EFFICIENCY FOR LIGHTING SYSTEMS

ALZAK *Aluminum Reflectors*

(REG. T. M.)

Improved lighting, obtained with Alzak Aluminum Reflectors is definitely constructive and important to war industries. Better light means better sight which, of course, means increased efficiency—more materiel for our armed forces. Using aluminum requires no more man-hours of labor; may even save on fabricating and installation time.

Let's review the advantages offered by Alzak Aluminum: Reflecting surfaces meet the requirements of every lighting job, diffuse or specular, and combinations of the two. Reflector shapes can be exactly what are needed for putting light where you want it; aluminum places no limitations on reflector shapes. The glass-like hardness of the Alumilite finish (process patented) makes cleaning easy, assures long life with continued high efficiency.

Alcoa does not make reflectors, only the aluminum sheet from which reflectors are formed. Ask your regular manufacturer of lighting fixtures about Alzak Aluminum Reflectors for essential war uses.

ALUMINUM COMPANY OF AMERICA, 2126 Gulf Building, Pittsburgh, Pennsylvania.

ALCOA ALUMINUM

Here's *Skilled Lighting*

Wheeler Vapolux Fixtures. Made in standard styles for 100 to 500 watt lamps. All joints dust-tight. Scientifically balanced heat dissipation. High light output.

Wheeler Globe-Type Fixtures. Dust-tight and vapor-proof. Made in standard styles for 75 to 200 watt lamps. Same high safety and lighting standards as Vapolux unit.

for Class II, Group G Locations!

In lighting fixtures for hazardous locations, the advantages of Wheeler "Skilled Lighting" show up even more outstandingly than in more common types of reflectors.

Wheeler Vapolux and Globe-Type Fixtures comply with all requirements necessary or desirable in class II-G locations. Also, they give you the high measure of light output, durability and ease of installation and maintenance that can only come from better engineering, backed by long experience. In every detail, Wheeler Lighting is "Skilled Lighting" developed with the experience of over 62 years' specialization!

Write for complete Catalog 50 containing full details of these high-efficiency, high-convenience units for Class II, Group G locations. **Wheeler Reflector Company, 275 Congress St., Boston 10, Mass.** . . . New York City. Representatives in principal cities.

Distributed Exclusively Through Electrical Wholesalers

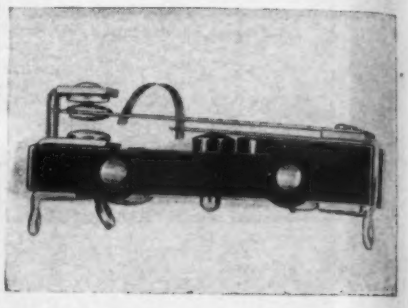
Wheeler REFLECTOR COMPANY

Lighting Equipment Specialists Since 1881

provide extreme sensitivity, a wide range of thermal ratings, and resistance to corrosion. Applications include use on storage tanks for automatic release of "floating roofs," also chemical plants where self-releasing action of valves would check running fires. Grinnell Co., Inc., 200 W. Exchange St., Providence 1, R. I.

Midget Switch

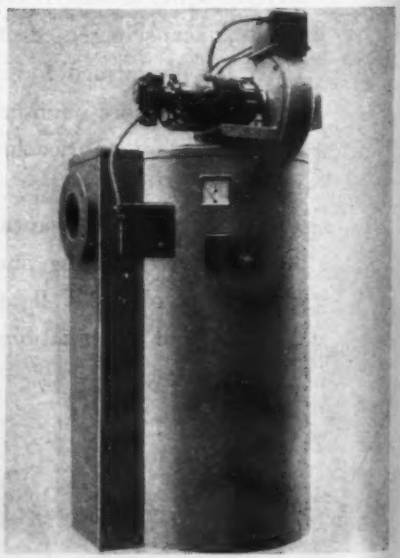
Midget switch, known as Acro-Snap, built on the rolling spring principle, is being made to the maximum dimension of 1½ inches. It is $\frac{5}{16}$ inch wide, $\frac{7}{32}$ inch thick, and weighs less than an ounce. Switch is designed for actuation from



either the top or the bottom, and is adapted to electronic control devices, machine tools, and electrical appliances. All component parts are non-corrosive. Both the snap-action spring itself and the center blade are made of beryllium, the base is bakelite. Available in single-pole, normally open, normally closed, and double throw with both pre-travel and over-travel provided. Acro Electric Co., 1309 Superior Ave., Cleveland 14.

Hot Water Generator

Fully automatic, oil-burning hot water generator, called Agitair, is designed especially for hot water and heating service where compactness, safety, and simplicity are required. Burner uses diesel or lighter fuel oil under positive pressure supplied by a low-speed motor. The Agitair generator is down-fired, with multiple pass over heat-absorbing surfaces. Combustion occurs in a carborundum chamber through which



Bearing Bronze In Its Most Usable Forms....

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● Bunting Bronze Standardized Bearings come to you completely machined and finished to the stated size and tolerances. They are made with absolute accuracy in all dimensions, entailing no further expenditure of labor and time for such operations in assembly. They fit practically all applications in machine tools, electric motors and general industrial machinery. They are readily adapted to other and unusual requirements.

Factory finishing of Bunting Bearing Bronze Bars saves you about 25% of purchased metal as compared with rough cast bars and about 50% of machining time, and keeps valuable scrap where it can be most economically utilized. This economy is passed on to the user.

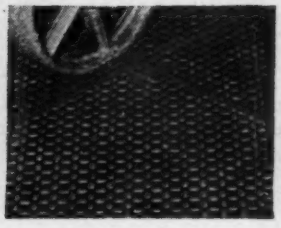
Ask your local wholesaler. Write for catalog of Bunting Bronze Bearings and Bars. Provide these items in the most modern and efficient forms for all machinery production and maintenance. The Bunting Brass & Bronze Company, Toledo, Ohio. Warehouses in Principal Cities.

Bunting

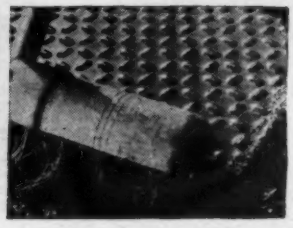
BRONZE BUSHINGS • BEARINGS • PRECISION BRONZE BARS

SAFETY
This patented tread pattern, shown life-size, provides as many as 60 skid-foiling buttons to grip and hold each shoe, every step. The flat-topped risers of Multigrip Floor Plate assure safe starts, turns and stops—wet or dry.

1. SAFE FOOTING



2. SURE TRACTION



3. QUICK CLEANING

...for men and vehicles

MEN are protected from injury, strains and fatigue by Multigrip Floor Plate. Vehicles roll easily, true to line—safely.

Laid over new or old concrete or wood floors, Multigrip Floor Plate furnishes complete floor protection. The safety pattern has no pockets to hold dirt and grease, is easily cleaned in any direction. Also drainage is quick and complete, no closed channels hold water. Speedy installation, long wear, minimum maintenance and low cost are some of the other advantages which have induced many plant engineers to install Multigrip Floor Plate.

Note the locations in your plant where mishaps, such as skids and falls, occur most frequently. Then make them safe by installing Multigrip Floor Plate.

For L.C.L. lots, buy from your local steel distributor

U·S·S MULTIGRIP FLOOR PLATE

UNITED STATES STEEL

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh and Chicago

Columbia Steel Company, San Francisco,
Pacific Coast Distributors

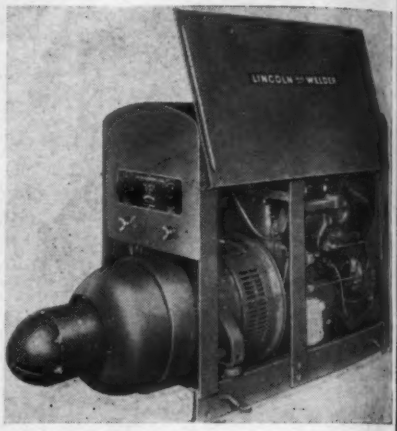
United States Steel Export Company, New York

USS

flame has a corkscrew travel. Absence of negative drafts and smoke is stated to eliminate necessity for special stack. Type A generator weighs 300 pounds, and is rated at 105,000 to 157,000 B.t.u., or 400 to 1000 sq.ft. equivalent direct radiation. Larger capacities are available. Air Devices, Inc., 17 E. 42nd St., New York 17.

Engine-Driven Arc Welder

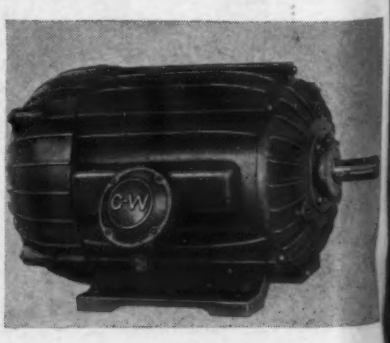
With a current range of 40 to 250 amperes, "Shield-Arc" engine-driven arc welder is driven by a rubber-mounted engine of 29 horsepower. Unit is supplied complete with base and canopy. Dual control of welding current is accomplished by adjustment of



series fields and generator speed. Generator control, or "job selector," is said to assure accuracy of open-circuit voltage and to permit precise control of engine speed from 1500 to 1150 r.p.m. for welding. This control also may be used manually to reduce engine speed to as low as 750 r.p.m. whenever it is necessary to stop welding at intervals of a few minutes. Rated current of 200 amperes is produced when the job selector is set, so that the machine operates at speeds as low as 1200 r.p.m. Unit weighs approximately 1130 pounds, has over-all length of 65¾ inches, width, 24 inches, and height, 41½ inches. Lincoln Electric Co., 13010 Coit Rd., Cleveland.

Corrosion-Resistant Motor

"Sealedpower" corrosion-resistant motor is intended for operation in atmospheres containing injurious dusts, corrosive vapors or gases, and excessive moistures. Available in sizes from 1 to 15 horsepower, it can be furnished for operation from any polyphase power supply. Motor is of the totally enclosed, fan-cooled type, with no cooling ducts to become fouled with wet



Plenty of Bombs for Berlin - *On Time*

Because of PRODUCTION CONTROL

STEWART-WARNER GAUGES FOR EVERY NEED

Ammeters and Voltmeters in all popular ranges and mountings.

Temperature Gauges. Mechanical or electric. Accurate and dependable. In all popular ranges and sizes.

Pressure Gauges. Mechanical or electric oil and air pressure gauges have precise mechanism. Ranges—0-15 to 0-400. All popular sizes.

Stewart-Warner Industrial Tachometers Accurately Measure Machine Performance When Output is Related to Rotation

IT TAKES a fabulous amount of parts, supplies, bullets, bombs, and fuel to blast an Axis hideout. Back of this miracle of American production is CONTROL. And on thousands of machines, the great story of CONTROL is written on the dials of Stewart-Warner Industrial Tachometers.

More and more leading machine designers now specify these amazing instruments as standard equipment. They assure efficient operating speed, hold quality to set standards, cut unit costs, synchronize machines with assembly lines, add to machine life, help meet quotas and schedules *on time!*

It's easy to add Stewart-Warner Tachometers to new or old machines. You get CONTROL at low cost—you know your production to the split second no matter what you make.

Write today for complete information about Stewart-Warner Industrial Tachometers.

Write for FREE Catalog on Industrial Instruments

STEWART-WARNER

INDUSTRIAL TACHOMETERS

1870 Diversey Parkway
Chicago, Ill.

Another Product of STEWART WARNER

Made by Saw Specialists with Highest Quality a matter of course . . . .

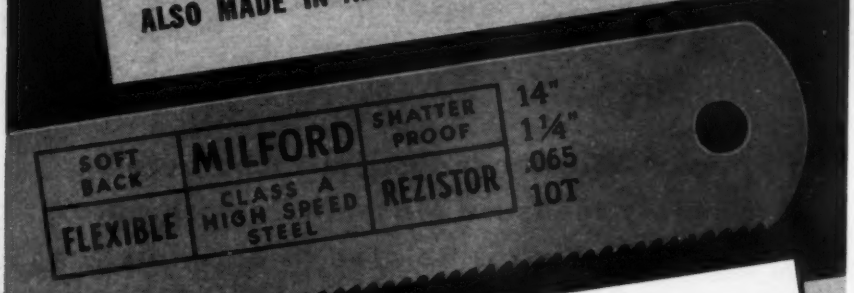
MILFORD

FLEXIBLE REZISTOR

HACKSAW BLADES

For consistently trouble-free production on automatically-fed hacksawing machines • shatterproof and unbreakable under excessive pressures and shocks • tough, improved steel guarantees faster cutting with more consistent, more uniform cutting life • hand blades have the same quality and stamina.

ALSO MADE IN ALL-HARD HAND AND POWER SIZES



• HAND SIZES HAVE EASY-STARTING TEETH •

A LEADING MANUFACTURER of hacksaw machines, well aware that the machine fails without the right blade, tells us that Milford Rezistor develops the full potentialities of their machines. And they know — they've tried them all!

THE HENRY G. THOMPSON & SON COMPANY

Saw Specialists Exclusively for Over 65 Years

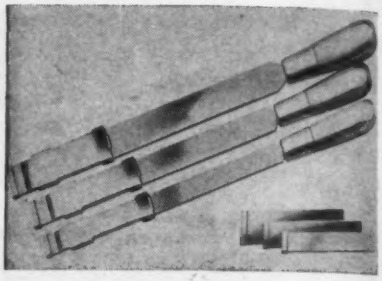
NEW HAVEN, CONNECTICUT, U. S. A.

also manufacturers of Milford Profile Saw . . . the blade for all contour and profile band saw machines.

or sticky dusts. All exposed parts are said to be acid- and alkaline-resistant to a high degree. In addition to mechanical sealing of the entire motor, each coil is individually sealed against destructive elements by the vacuum impregnation process. Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.

Scraper Blades

Carboloy tipped scraper blades are now available in three widths to fit the manufacturer's standard line of hand scrapers. It is



necessary only to remove the high-speed steel blade and slip in the Carboloy tipped blade, which is claimed to last many times longer. Anderson Bros. Mfg. Co., 1907 Kishwaukee St., Rockford, Ill.

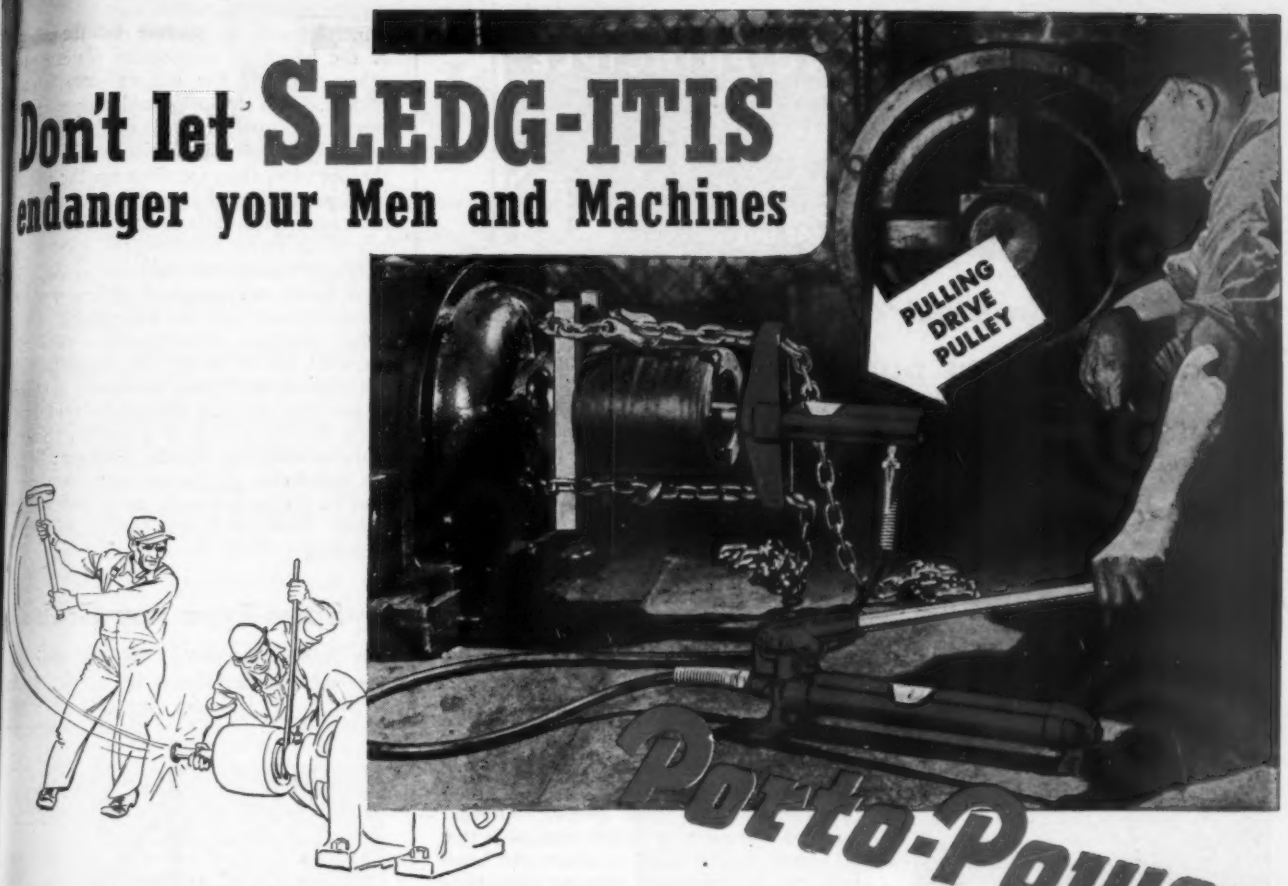
Compressor Control

Developed to protect water-cooled compressors against overheating if operated without cooling water, compressor control also prevents waste of cooling water when compressor is inoperative, according to the manufacturer. Type M consists of a sight-flow fitting, mounted in water discharge pipe, that serves as holder for a metal electrode. When receiver pressure falls below predetermined level, pressure switch opens a solenoid-controlled valve to admit cooling water to compressor. Compressor is not started until water flows through it and into the sight flow, completing circuit with electrode. If water supply fails, compressor is stopped. Type U functions similarly for an unloading compressor, and either stops compressor or sounds warning alarm if water supply fails. Johnson Corp., Three Rivers, Mich.

Industrial Scale

Industrial fan scale known as Detecto-Gram is constructed on the even balance

Don't let SLEDG-ITIS endanger your Men and Machines



Porto-Power

Beat Hercules At His Own Game With

SUPPOSE you had tons of power in your fingers—to pull, push, spread, pinch, lift, clamp and bend! *What miracles you could accomplish in maintenance work and manufacturing!*

Actually Porto-Power enables you to *apply* tons of hydraulic power as flexibly as you use your fingers — and with absolute safety!

Pulling gears and wheels, straightening shafts, bending pipe, separating heavy dies, pressing tight-fitting assemblies or keys into place—these are only a few of the 1001 uses for Porto-Power in industry.

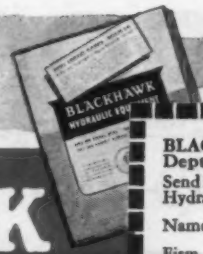
Porto-Power saves time and machines —makes tough jobs easier and safer for men—replaces damaging and dangerous sledging, heating and prying. It is fast becoming standard hydraulic service equipment in production plants, shipyards, construction companies, repair and maintenance organizations.

Write Blackhawk or call your industrial supply distributor for complete information on Porto-Power in 7, 10, 20 and 50-ton capacities.

A Product of

BLACKHAWK MFG. COMPANY

Department P2734 Milwaukee 1, Wisconsin



ARMY NAVY

BLACKHAWK

Hydraulic Equipment—Wrenches

BLACKHAWK MFG. COMPANY
Dept. P2734, Milwaukee 1, Wis.
Send catalog on Porto-Power and complete wartime Hydraulic Equipment line.

Name_____

Firm_____

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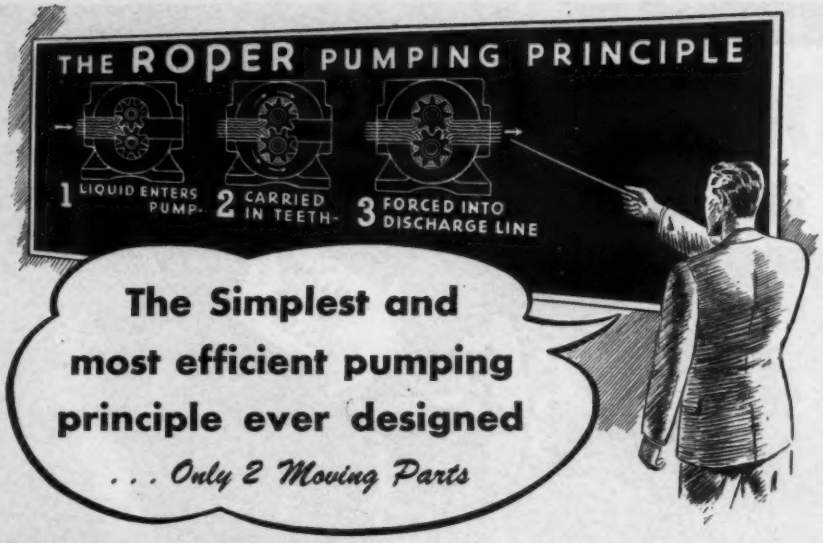
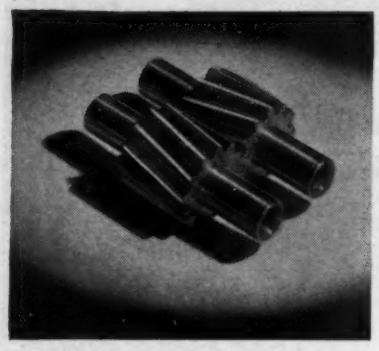
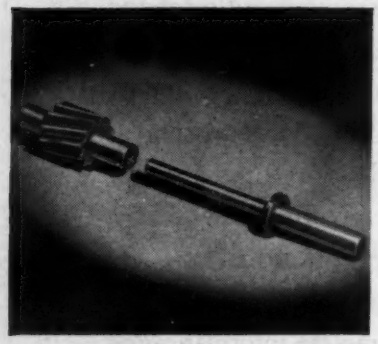

THE ROPER PUMPING PRINCIPLE
1 LIQUID ENTERS PUMP-
2 CARRIED IN TEETH-
3 FORCED INTO DISCHARGE LINE
The Simplest and most efficient pumping principle ever designed
. . . Only 2 Moving Parts



EQUAL SIZE PUMPING GEARS

The only moving parts in a Roper Pump are these two equal size pumping gears. They operate in a case with just enough clearance to prevent wear.



HYDRAULICALLY BALANCED

Entirely separate from drive shaft, the pumping gears actually "float in operation". Any thrust or shock is absorbed by sliding joint and thrust collar.

Why You Should Specify ROPER

SIMPLEST DESIGN. The Roper design is recognized as the simplest ever conceived. Only two moving parts . . . equal size pumping gears (either spiral or spur) operating at the same speed. Another important feature of Roper design is that all internal parts such as gears and bearings can be inspected without disturbing piping or power.

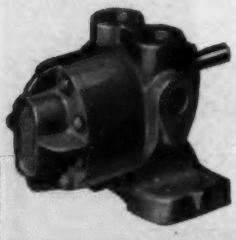
LONGER LIFE. The four large replaceable bearings, two on each side, in Roper "hydraulically balanced" pumps are designed and constructed to withstand severe operating abuses and adequately handle peak loads. These flanged high lead bronze bearings also act as wear plates to protect face and backplate from wear. Can be replaced easily and inexpensively.

SAVE FLOOR SPACE. Roper Pumps are designed to operate at direct motor speeds, thus eliminating gears, belts, etc. Roper "direct-drive" pumps require only 48% as much floor space as other models

POSITIVE DELIVERY. Roper Pumps produce a steady, positive flow absolutely free from pulsation.

HYDRAULICALLY BALANCED

Write for Catalog No. 338



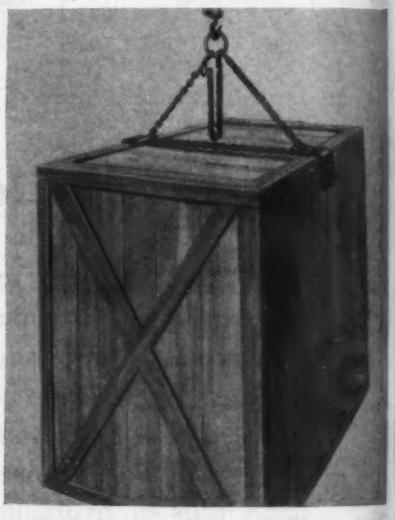
ROPER
Rotary Pumps

GEO. D. ROPER CORP., ROCKFORD, ILL.

principle, with the reading dial at one end of the base, the commodity plate at the other end, and the weight plate in the middle. This design is said to permit all three vital points concerned with the weighing to be in direct line of vision with the operator, thus speeding up the weighing operation, and assuring maximum of accuracy. This scale is available without beams for direct weighing purposes where weights are employed, and is also made up with one or two beams. Tare beam, which is used to account for the weight of the empty container, is fitted with a small adjustment ball to permit the adjustment of the slightest fraction of an ounce. A choice of five standard dials from 1x1/100-lb. dial to a 1000x5-g. dial is available. Special dials are made for specific purposes. Scales are obtainable at various capacities; commodity platters are made up to suit specific needs. Detector Scales, Inc., 1 Main St., Brooklyn 1, N. Y.

Spike-Type Box Grab

Box grab for grabbing, holding, and lifting large wooden boxes up to 5 feet in width, is available in capacities of 1000, 2000, 3000, or 4000 pounds. Gripper



plates are fitted with replaceable cone-headed spike bolts. Length of the chain can be adjusted for high or low ceilings. Palmer-Shile Co., 7110 W. Jefferson Ave., Detroit 17.

Timers

Continuous-running repeat-cycle timers, known as Series No. 5800, are available with either a.c. or d.c. operation, from one through eight switches as required. A wide range of motors is obtainable, from 8 r.p.m. down to 1 revolution per month, or even 1 revolution per six months if desired, through Haydon sealed-in, lubricated gear trains. Precision snap switches are used, single or double throw, of 10-amp. capacity at 110 volts a.c. Adjustable cams can be set to throw the switches from 1 to 180 degrees of the revolution, and specially cut cams are available for various "on" and "off" combinations ranging from more than one actuation per second down to one per month. Haydon Mfg. Co., Forestville, Conn.

Air Casualties

It's bad air that does it. But you can step up production by putting a Coppus Blower on the job to keep the air moving — and keep the men cool.

The kind of air a man works in has a lot to do with how much work he can turn out.

In confined places like shipholds or tanks or drums or boilers . . . or wherever the air is stagnant or hot or full of fumes . . . a Coppus Blower is a *must* for getting first-class work out of the men, all the time.

A Coppus Blower or Exhauster helps avoid sickness and lassitude due to bad air . . . and improves morale, too.

Portable and adaptable for special purposes, Coppus Blowers and Exhausters will have dozens of uses around your plant. The "Blue Ribbon" (a blue painted band) is your assurance of quality performance at lowest cost.

COPPUS

BLUE RIBBON BLOWERS

THE BLOWERS THAT PUT MORE MINUTES IN EVERY MAN-HOUR

CABLE MANHOLE AND TANK VENTILATORS — BOILER MANHOLE BLOWERS AND EXHAUSTERS — HEAT KILLERS — SHIPHOLD VENTILATORS . . . DESIGNED FOR YOUR INDUSTRY — ENGINEERED FOR YOU

MAIL THIS COUPON To Coppus Engineering Corp., 453 Park Avenue, Worcester, Mass. Sales offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in SWEET'S CATALOG.

PLEASE SEND ME INFORMATION ON SUPPLYING FRESH AIR TO MEN WORKING:

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fusilages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausting welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.
- ☐ drying of walls, sheets; etc., after treated with coating material.

NAME .....

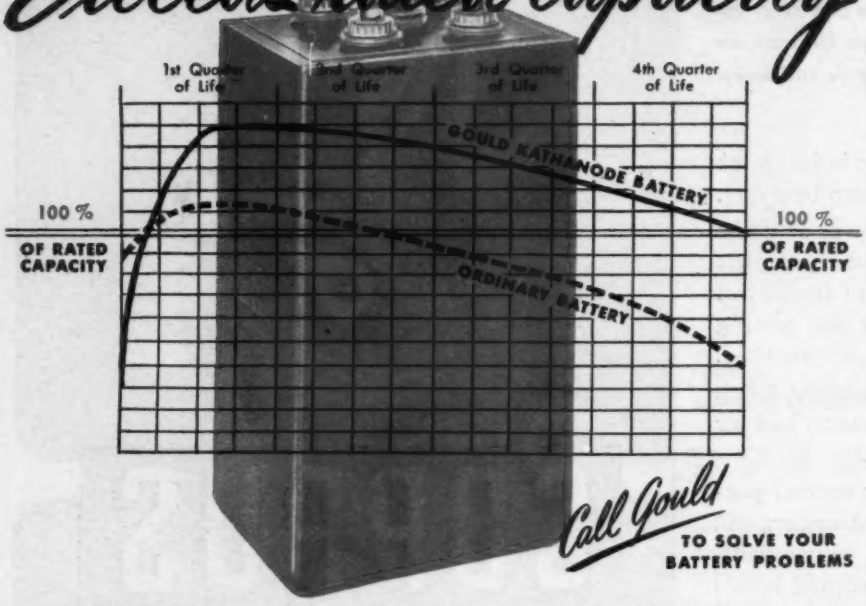
COMPANY .....

ADDRESS .....

CITY .....

(Write here any special ventilating problem you may have.)

THE GOULD KATHANODE
Exceeds rated capacity

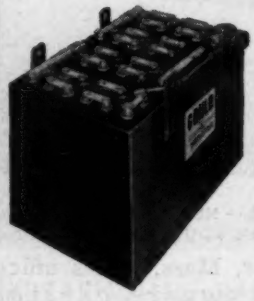


Call Gould TO SOLVE YOUR BATTERY PROBLEMS

Rated Conservatively . . . Goulds equal or exceed in capacity any battery of comparable size and cell structure.

★

Are you receiving the monthly, informative "Gould Battery News"? If not, write for it.



• Here are the capacity ratings of two batteries. The top one is a Gould Kathanode. It starts near catalogue rating. Then, as it is cycled, capacity actually increases to a higher level that is held for the greater part of the battery's useful life.

Gould's special Kathanode grid construction and spun glass retainer mats allow for more active material to remain in contact with the electrolyte. That is one reason for this extra capacity.

Black oxide, the unique Gould active material in these grids, has cores of pure lead. As the outer surface wears away, these cores become new active material to maintain that extra capacity throughout a long battery life. That is why the capacity of the Gould Kathanode increases during the first few years of its life.

You get more when you buy Gould so learn all the facts. Ask for the Gould Kathanode Bulletin, using business letterhead.

GOULD STORAGE BATTERY CORP.

DEPEW, N. Y. • Factories at Depew, N. Y. • North Bergen, N. J.
Zanesville, O. • Dallas, Texas • Atlanta, Ga. • Chicago, Ill.
St. Paul, Minn. • Leavenworth, Kan. • Los Angeles, Cal.

ARMY E NAVY — *FOR EXCELLENCE IN STORAGE BATTERY PRODUCTION AT DEPEW PLANT*

GOULD

Since 1898 THE BATTERY PICKED BY ENGINEERS

HOW TEMPERATURE AFFECTS SPECIFIC GRAVITY

One of a series of service suggestions for users of industrial batteries.

◀ In taking hydrometer, or specific gravity, readings of a storage battery the temperature of the electrolyte is an important factor. Few operators, however, take temperature into consideration and, as a result, their readings are not entirely accurate.

This is due to the fact that hydrometer floats are calibrated to indicate correct specific gravity at a certain definite temperature. On the better grades of hydrometers this base temperature is indicated on the scale, and whenever a variation from this temperature occurs a correction must be applied.

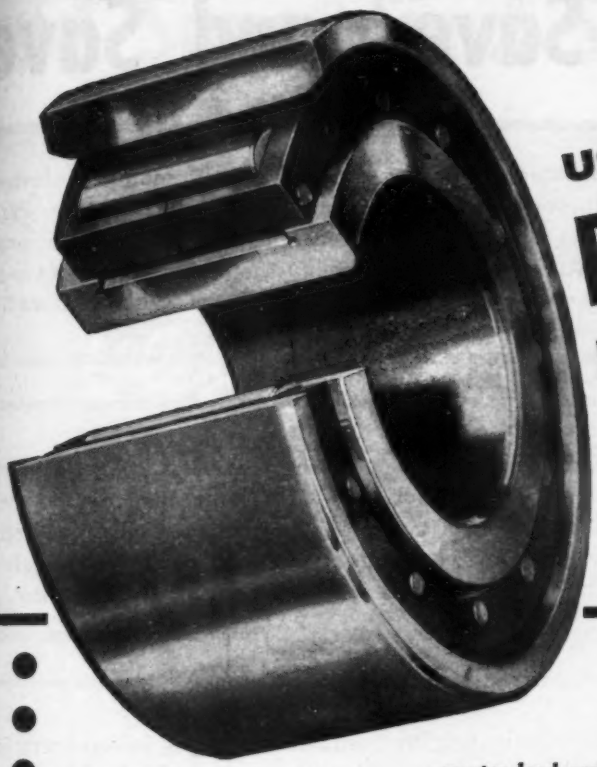
The reason for this correction lies in the fact that specific gravity is a relative term. Strictly speaking it is the density, or weight, of a liquid as compared to an equal volume of pure water at 4° Centigrade. This is much too cold for ordinary use so hydrometer scales are usually calibrated at 25°/C. 25° C., which means that the scale has been adjusted to compare the specific gravity of the electrolyte to a similar volume of pure water when both have a temperature of 25° Centigrade, or about 80° Fahrenheit.

When there is any change in the temperature of the electrolyte from this basic 80° F., it means that you are trying to compare the specific gravity of one solution at a certain temperature to another at a second and different temperature. This is beyond the capabilities of the hydrometer and corrections must be made.

This temperature correction is easy to apply. Just remember that when the temperature is high, the electrolyte has expanded and is not so dense as before. This causes the hydrometer float to ride low and give readings higher than the true reading. Conversely, when the electrolyte is cold the float rides high and gives figures that will err the other way.

To make these corrections add or subtract 3 points of "gravity" (.003) for each 10° F. change in temperature—battery temperature, *not* air temperature. The calibrated point is 80° F. If the temperature is 10° F. above 80° F., add. If below, subtract. Example: A hydrometer reading of 1.250 at 90° F. is really a hydrometer reading of 1.250 plus .003 or 1.253. *(Advertisement)*

Design Now for Higher Hourly Production After the War



Type MCS
Double Width

use ROLLWAY Right-Angle BEARINGS to Carry the Load...

Production rates per man and machine-hour rose sharply after the last war. They'll go higher after this war. That's why postwar machines MUST be designed for heavier loads and higher speeds. And that's why the greater load capacity, the longer bearing life, and the lower maintenance costs of Rollway Right-Angle Roller Bearings are vitally important to your postwar designs, right now.

Rollway Right-Angle Loading Reduces the Unit Load

For compound loads, diagram shows how SEPARATE radial and thrust bearings are used in combination:

- **All radial loads carried at right angles to the roller axis**
- **All thrust loads carried at right angles to the roller axis**

Right-Angle loading limits the load carried by each bearing to a single, simple load component—*either pure radial or pure thrust*. Thus the unit load per roller is lower, the load capacity for a given dimensional limit is higher. No oblique loads or resultants, no other compound loads can pile up to increase the magnitude of the simple radial or thrust component. Resistance to shock and vibration is increased. Pinch-out of rollers is eliminated—there's less rubbing friction, and less wear-back of roller ends. The net gain is clearly apparent in longer bearing life and lower maintenance cost.

Standard Sizes for Most Applications

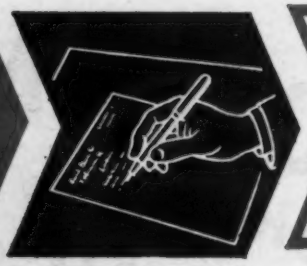
S.A.E. or American Standard metric dimensions and tolerances in a wide range of sizes and types assure low cost and ready availability for most applications. Special designs are rarely necessary. Let our engineers help you select the types best suited to your needs. Just send a drawing or detailed description for free, confidential analysis and recommendation. No obligation.

ROLLWAY BEARING COMPANY, INC., SYRACUSE, NEW YORK

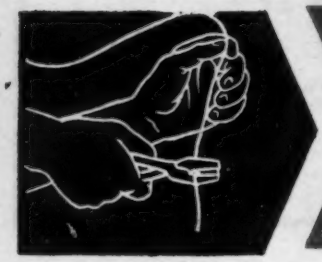
BUILDING HEAVY-DUTY BEARINGS SINCE 1908 **BEARINGS**

You Save[1] and Save[2] and Save[3]

1 SAVE ORDERING TIME



Instead of buying two separately mounted devices—a motor-circuit switch and a magnetic starter—you buy one factory-co-ordinated unit that controls and protects your motor. Simply specify the motor rating and indicate the type of motor-circuit switch you want—and we'll send you the control you need.

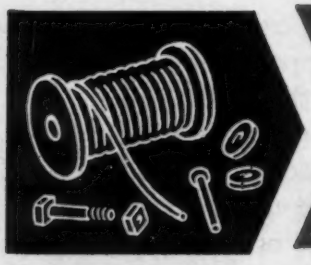


2 SAVE INSTALLATION TIME

Users report a 50 per-cent reduction in mounting time, 40 per-cent reduction in wiring time, as compared with the installation of two separate devices. You mount one device—not two. You connect only nine terminals—not fifteen. You get your motors into operation quicker.

3 SAVE MAN POWER

By eliminating one complete mounting job on every installation, you save valuable man power. And because the cover cannot be opened while there is power on the starter, your men have more protection against accidental injury.

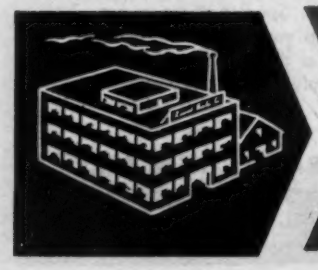


4 SAVE CRITICAL MATERIALS

By buying both the motor-circuit switch and the magnetic starter as one compact unit, you save copper wire, steel conduit, and fittings that are necessary for installing two separately mounted devices—plus the saving gained by using only one steel enclosure instead of two.

5 SAVE MONEY

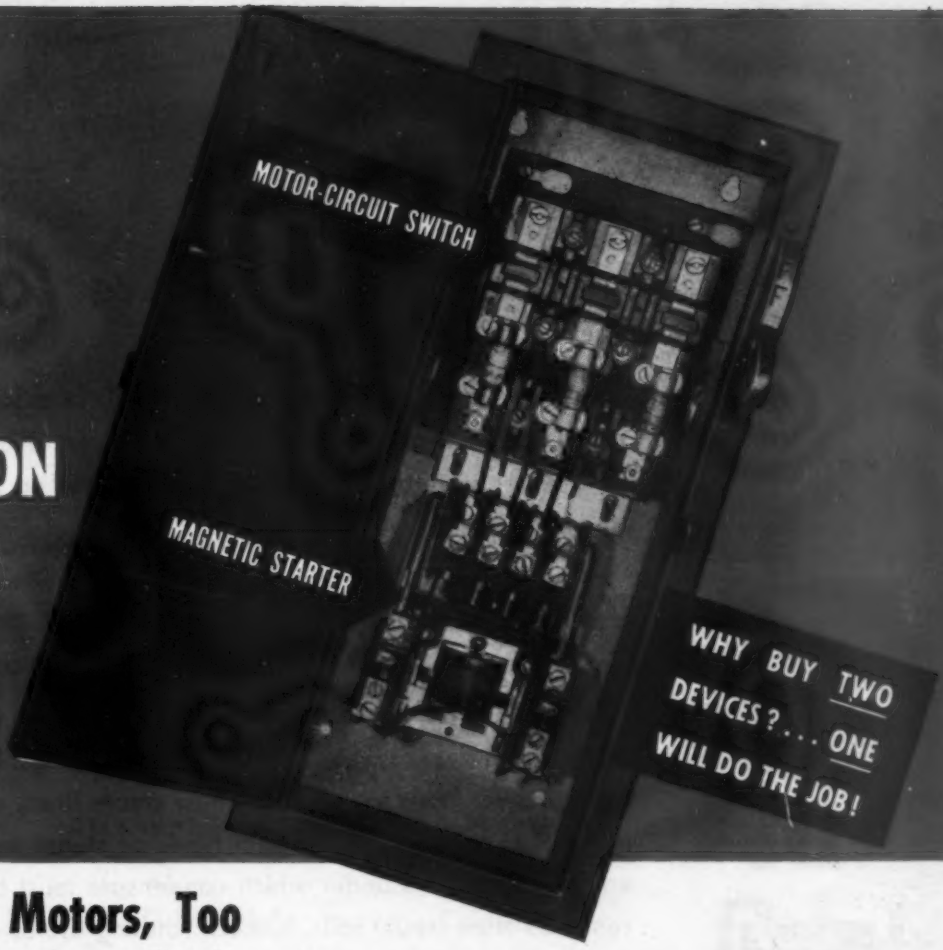
Combination starters cost slightly more than two separately mounted devices, but this difference is more than made up by the savings in wire, conduit, fittings, and installation-labor costs. This statement is based on the actual experience of users.



6 SAVE PLANT SPACE

Combination starters take up less mounting space than separately mounted safety switches and starters. Because of this you can mount them in small, unused places near the operators.

and Save[4] and Save[5] and Save[6]...



GE

COMBINATION STARTERS

- - - and Save Your Motors, Too

With G-E combination starters, you're sure that the motor-circuit switch or breaker has the proper rating and interrupting capacity for the magnetic starter with which it is used. The fuses or breaker are co-ordinated with the thermal overload relays to give complete motor protection under short-circuit or overload conditions.

It's the simple, logical way to get control and protection for your motors—in one compact, easy-to-install unit. Why buy two devices, when this one will do the job?

NAME YOUR HAZARD

G-E combinations come in enclosures to meet any operating condition: dust-tight, watertight, oil-immersed, general-purpose, or for hazardous locations. Available for motors from 1 to 1000 horsepower.

GENERAL ELECTRIC

Next time you order motor control, save seven ways by specifying General Electric combination starters.
General Electric Company, Schenectady, N. Y.

Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds.

General Electric Company, Section L676–129
Schenectady, N. Y.

Please send me the bulletins checked below:

- GEA-3715—Combination starters: general-purpose, watertight, and dust-tight
- GEA-3660–2300-volt combination starters
- GEA-3804—Combination starters for hazardous locations
- GEA-3541—Oil-immersed starters

Name.....

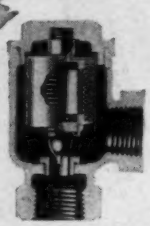
Company.....

Address.....

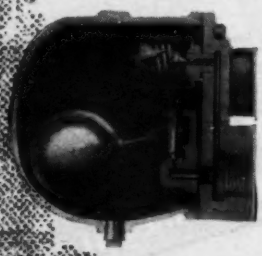
City.....State.....

The Skunk under the Barn

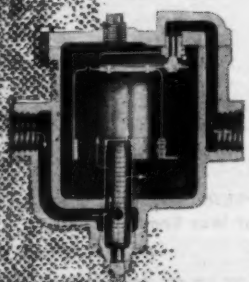
in the Steam-using Industries



Sarco No. 9 thermostatic steam trap



Sarco float-thermostatic steam trap



Sarco inverted bucket steam trap

Sarco No. 87 steam trap-control

You can't see condensate in a steam coil, or a supply line. Unfortunately, you can't smell it either, but the steam engineer in your plant can tell you about where it is and how it slows up your production.

Given the right tools, this "skunk under the barn" can be completely eliminated from your plant in a few hours. The tools consist of small, inexpensive steam traps that can be slipped into the lines like a coupling or an elbow, without necessitating any shut down.

The results are frequently phenomenal. Right now the increase in production and decrease in rejects are the big things. In some plants they make unnecessary new boilers, new steam lines, or new plant additions. Sarco makes four distinct types of steam traps to meet all the varying conditions under which condensate must be drained and air removed from steam coils, jackets, rotating drums or heating surface. Let the Sarco man advise you.

Production Improvement is Post-War Planning. Anything along these lines that you do to increase your production now will result in lower costs per unit and higher quality of production in your post-war output.

The Sarco Hook-Up Book for steam engineers gives specific recommendations on many of these ideas, together with computation tables and a description of Sarco products.

SARCO COMPANY, INC.
475 FIFTH AVENUE
NEW YORK 17, N. Y.

Representatives in Principal Cities

SARCO Saves Steam

SARCO CANADA, LTD. 37 Richmond Street West, TORONTO, ONTARIO

SUNNEN Solves Another Problem

The Job

Collet — .305″ hole, hardened. Stock removed .002″. Tolerance — Minus .000″ plus .001″. *Finish* — 2 to 3 micro-inches — practically all parts tested on Brush Surface Analyzer for micro finish and inspected under Comparator. Previous method used — hand lapping.

Time saved by Sunnen Honing — 35%.

"Since installing our first Sunnen Honing Machine we have constantly added more and more parts to pass through the honing process. We now have six machines in use."

— Fidelity Machine Company

SUNNEN HONING provides a finish of 2 to 3 micro-inches — and at a saving of 35% in time!

Airplane Engine Parts accurately honed to a super-smooth finish.

Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.

Aviation Hydraulic Cylinder made of Aluminum-Alloy. Improves the quality of the bearing surface. An extremely smooth surface-finish is secured.

Aircraft Valve Tappet Roller. 4-Micro finish.

"Produced an extremely accurate and glass-like finish."

Diesel Engine Fuel Injector Cylinder "So accurate that a piston can be fit within .00005 inch."

Accuracy — and a super-smooth finish with a real increase in production which means a saving in cost. That's the record of the Sunnen "MA" Precision Honing Machine in the modern plant of the Fidelity Machine Company.

This one example is indicative of the many reasons why hundreds of leading manufacturers handling important war contracts have adopted Sunnen Honing.

Consider These Advantages

Wide range — handles internal diameters of .185″ to 2.400″. Accuracy within "one-tenth" guaranteed — has been held to .000025″ on production jobs. Relieves big internal grinders for other jobs. Corrects errors of out-of-roundness or taper caused by previous operations. Facilitates duplication of sizes. Does not require skilled labor. Practical — inexpensive — economical to operate.

Put Sunnen Honing to work in *your* plant!

SUNNEN PRODUCTS CO., Manchester Ave., St. Louis, Mo.

Canadian Factory, Chatham, Ontario

Send for FREE BULLETIN

— Giving complete information. Or, if you prefer, a Sales Engineer will call and demonstrate this equipment in your plant, on your job.

SUNNEN

WHIZ Floor Primer and Cleaner removes imbedded dirt and wax from wood, linoleum, rubber, asphalt, cork, terrazzo, and concrete floors—desk tops, table tops, metal furniture, venetian blinds, woodwork, etc. Truly a remarkable cleaner and pre-wax treatment.

A real labor saver—cleans chemically without scrubbing. Just spread over surface, let stand few minutes, rinse off. Penetrates pores, flushes out imbedded dirt and grime. Wax base acts as filler, seals openings, becomes a binder between surface and next wax treatment. ***Write R. M. Hollingshead Corp., Camden, N. J., for name of nearest distributor.***

Liquid and Powdered Hand Soaps • Protective Hand Cream • Scrubbing Soaps • Cleaners • Floor Waxes (Heavy Duty and Self-Polishing, Liquid Oil Base and Paste) • Disinfectants • Odorless and Concentrated Insecticides • Furniture and Metal Polishes • Drain Pipe and Bowl Cleaner • Ho-zef Degreasing Compound • Hydraulic Fluids • Rust Preventives.

Hollingshead WHIZ
LEADER IN MAINTENANCE PRODUCTS

BUY MORE BONDS

YOU WANT TO KNOW

more about the items mentioned on this page

Letters to the addresses given will bring information

• DISCUSSIONAL SLIDE-FILM kit-sets now completed are: (1) "Light on Mathematics," with 24 subjects, to give a background in arithmetic, geometry, algebra, and graphs; (2) "Mechanical Drawing and Drafting," a series of 18 slide-films, covering basic and more advanced geometric constructions and mechanical drawing projects. Films are made available by The Jam Handy Organization, 1775 Broadway, New York.

A STOP NUT, elliptical at the top and round at the bottom, grips the threads of a bolt so firmly that no vibration can pry it loose, claims the manufacturer. Nuts are available in both U. S. Standard and SAE thread from ¼- to 1½-in. bolt size in mild steel, alloy steel, brass, and plated finishes. Stover Lock Nut & Machinery Corp., Bushkill Dr., Easton, Pa.

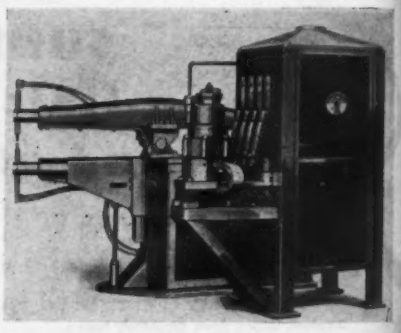
• THE PROBLEM of speedy settlement of terminated government contracts has been studied by the Sperry Gyroscope Co., Inc., and its findings are presented in booklet form. Complete details of operating procedures, and illustrations of forms for accumulating and checking claim factors, are included. Booklets are available on request from systems and methods technicians at any Remington-Rand, Inc. office.

• THE UNIT LOAD principle and its application to shipping, receiving, and warehousing operations are described in a bulletin compiled by the Industrial Truck Statistical Assn., 208 So. La Salle St., Chicago 4. Case studies show what has been accomplished in materials handling. Booklet available upon request.

• A FILTER MATERIAL containing as many as 6400 perforations to the square inch, was discovered accidentally by laboratories pioneering in the use of natural rubber latex. Available for vital products only, the filters have speeded production in many fields, from the preparation of blood plasma to silver plating the bearings of airplane engines. Further information can be obtained from the United States Rubber Co., Rockefeller Centre, New York.

• SCALES and similar precision work requiring a silhouette of extreme contrast can be reproduced from master artwork, or to company specifications, by The Maynor Corp., 10894 Berea Rd., Cleveland 2. It will do the work on plain or coated flat surfaced metals or plastics, and claim easily read numerals with no background glare, for the finished product.

• TELEPHONES FOR WAR are the subject of "Battle Talk," published by Western Electric Co., 195 Broadway, New York, for its employees. Action photographs, drawings, diagrams, and text go behind the scenes in war plants, planes, and battleships, to demonstrate the manner in which telephones and radio command sets transmit vital orders.



BATTERY POWERED WELDERS make possible resistance welding, even in aluminum, where power supply limitations have heretofore prevented the use of other forms of stored-energy welders. The storage battery, of special design, is trickle-charged. Welding is similar to that followed with usual forms of resistance welders. Progressive Welder Co., 3050 E. Outer Drive, Detroit 12

• ADMINISTRATIVE PROBLEMS faced by the present-day executive are answered in "Graph-A-Matic Management Control," a 72-page brochure covering control of production, materials, procurement, personnel, sales, and accounting systems. Effective operation methods are illustrated and described. A complimentary copy is offered to any business executive who forwards a request on company letterhead to Systems and Methods Research Dept., Remington Rand Inc., Buffalo 5.

• PLACING A HEAVY 250-lb. coil of wire on a horizontal reel no longer needs to be back-breaking work. The F. J. Lit-

Saved! 27,600 POUNDS OF GREASE!

SUN LUBRICANTS

Cut Grease Consumption 92% . . . Save $2874.00 a year

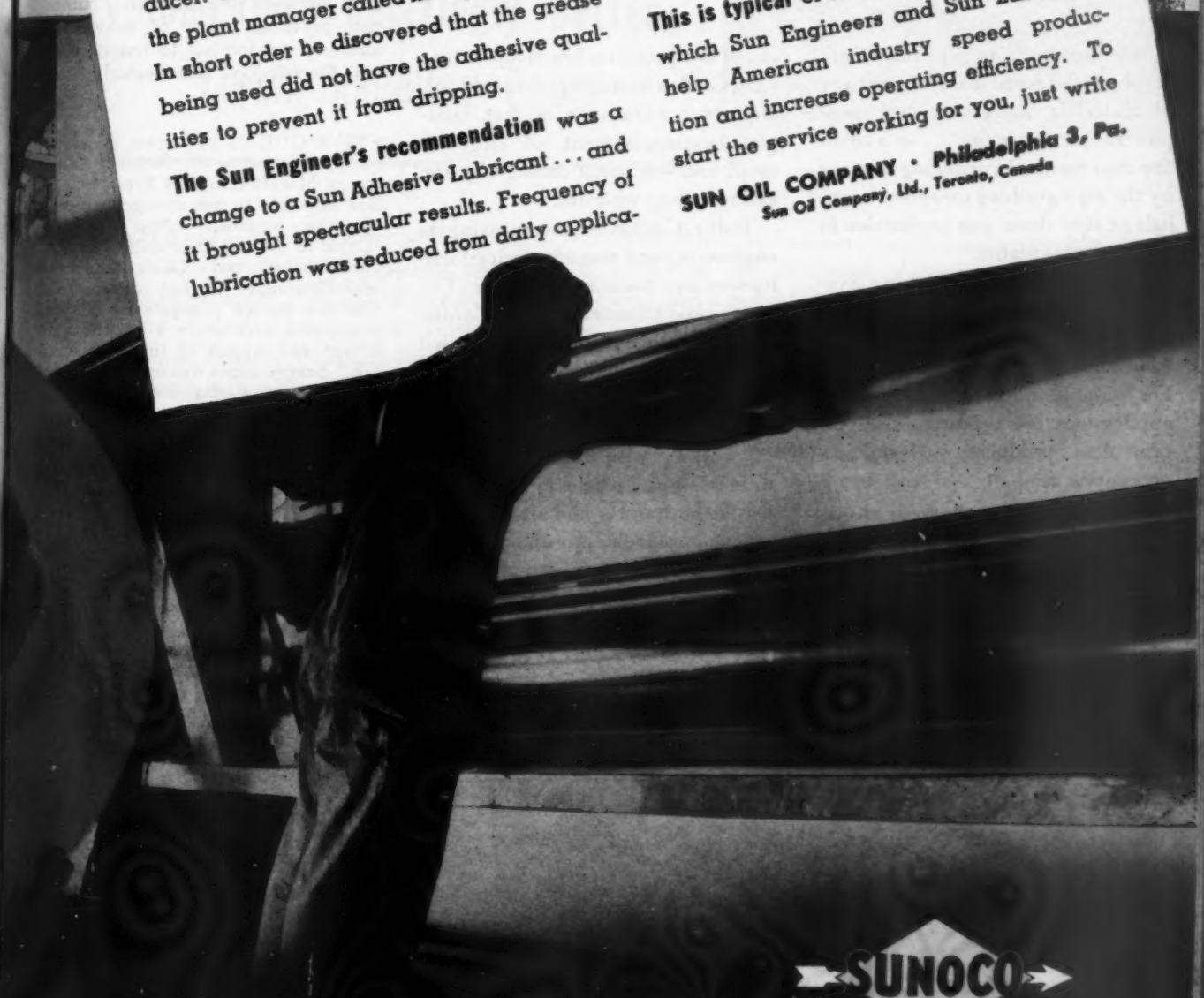
When a change in lubrication cuts grease consumption 92% . . . it's news that should interest management in any industry.

30,000 pounds of grease a year to lubricate the open gears of one paper-making machine was the problem of an eastern producer. Dissatisfied with this performance, the plant manager called in a Sun Engineer. In short order he discovered that the grease being used did not have the adhesive qualities to prevent it from dripping.

The Sun Engineer's recommendation was a change to a Sun Adhesive Lubricant . . . and it brought spectacular results. Frequency of lubrication was reduced from daily application to application once every two weeks — a saving of 27,600 pounds of grease a year. This 27,600 pounds meant $1714.00 less spent for lubricant, $1160.00 less for labor, or a total saving of $2874.00. On the basis of this performance, use of the same Sun Lubricant has been extended to eight machines in the mill, with a corresponding increase in savings.

This is typical of every day service through which Sun Engineers and Sun Lubricants help American industry speed production and increase operating efficiency. To start the service working for you, just write

SUN OIL COMPANY • **Philadelphia 3, Pa.**
Sun Oil Company, Ltd., Toronto, Canada



SUNOCO

SUN INDUSTRIAL PRODUCTS HELPING INDUSTRY HELP AMERICA

Winning the "*Battle of Production*" involves a lot more than a supremacy of materials, machinery and manpower. One major fire . . . or a small fire that results in crippling damage by the extinguishing medium . . . can halt or slow down war production in a dozen vital plants.

Cardox Fire Extinguishing Systems are guarding against these crippling fires in plants producing a wide variety of critical war products. For example, individually engineered applications are on duty in important plants producing such military necessities as:

Airplanes, Aviation Engines, Aviation Carburetors, Airplane Parts, Engine Parts, Plastics, Rubber Products, Processed Fabric, Tanks, Tank Engines, Cold Strip Steel, Armor Plate, Forgings, Solvents, Motor Fuel, Electric Power.

By instant smothering of fire and cooling of combustibles through the mass discharge . . . at high rate of flow . . . of low pressure, low temperature CO_2, Cardox Systems provide the all-important advantage of fast, complete extinguishment of large or small fires—without damage by the extinguishing medium.

Today, Cardox is concentrating its engineering and manufacturing facilities on two basic activities: (1) Designing and manufacturing of Cardox Fire Extinguishing Systems needed to make it possible for the Armed Forces of America to have more planes, guns, tanks and ammunition; (2) working with industry on plans to increase the efficiency of fire protection both today and after the war.

If you would like more information, write on company letterhead for Bulletin 1134

CARDOX CORPORATION
BELL BUILDING • CHICAGO, ILLINOIS

District Offices In New York • Boston • Washington • Detroit • Cleveland • Atlanta • Pittsburgh • San Francisco • Los Angeles • Seattle

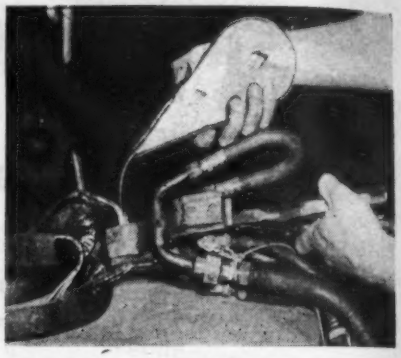
★ **BUY WAR BONDS** ★

ENHANCED COOLING EFFECT
CENTRAL STORAGE UNIT
AMPLE CO_2 RESERVE
ENGINEERED SYSTEMS
AUTOMATIC

CARDOX

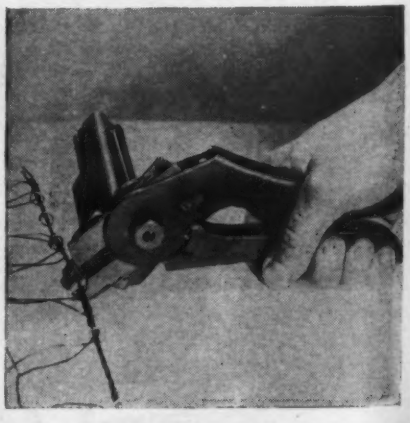
NON-DAMAGING FIRE EXTINGUISHING SYSTEMS

tell Machine Co., 4187 Ravenswood Ave., Chicago, has manufactured a drop center reel that the coil can be rolled onto before being lifted by motor to be slipped into operating position.

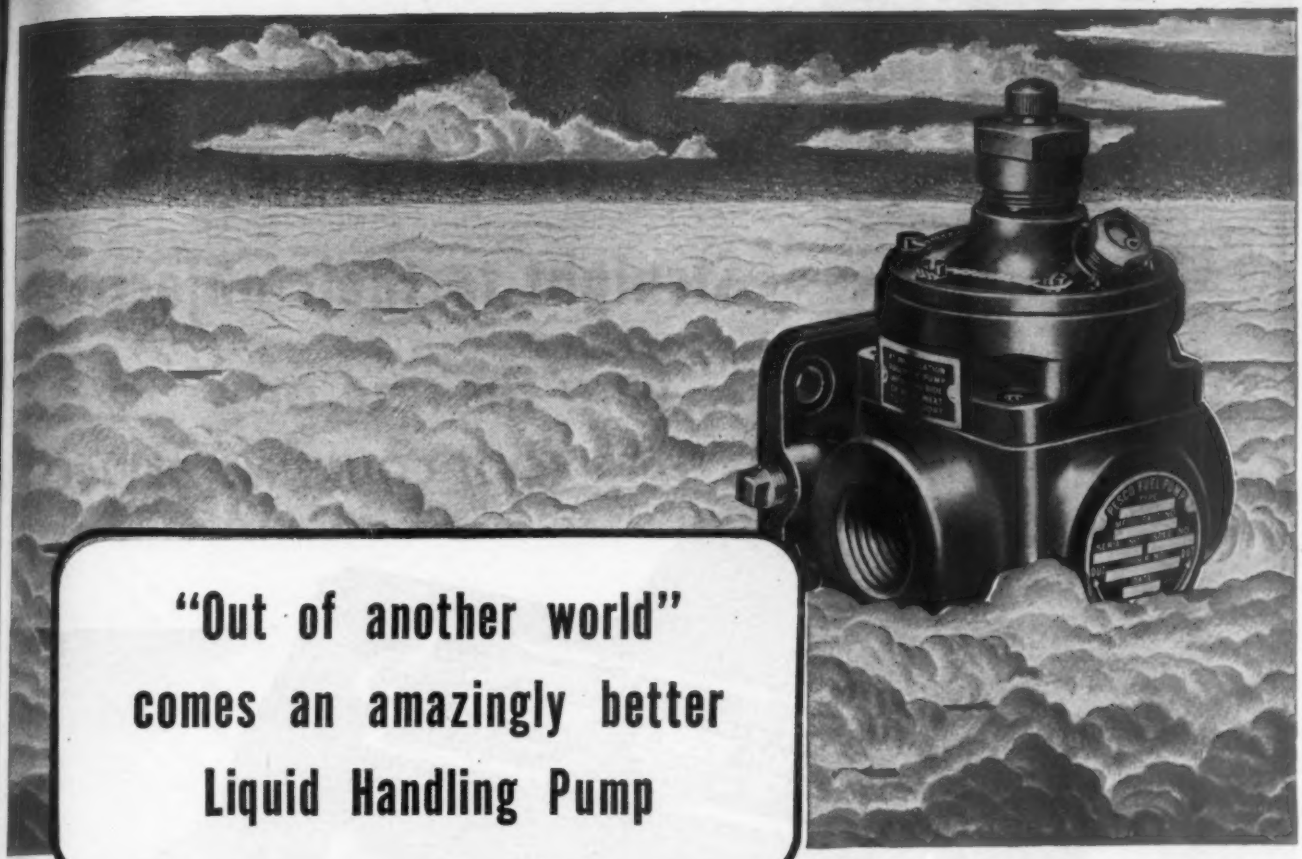


SILVER SOLDER DISPENSER is so constructed that the solder is thumb-fed over a roller and out the point of the dispenser through a slot in the edge of the case. This permits the operator to keep his hand far enough from the work to avoid being burned, and prevents waste of solder that formerly got too hot to handle. General Electric Co., Schenectady

• FIVE GUIDES to postwar preparation are being issued by the National Association of Manufacturers, 14 West 49th St., New York 20 "to spur management on to aggressive planning." Now ready are "Guide to Internal Organization for Postwar Planning" and "Guide to Postwar Sales Planning." The fact is stressed that "company postwar preparation is of future consequence only where it has the active interest and support of the chief executive." Sample copies free upon request, $7 for 100 copies of either booklet.



STAPLING PLIER, magazine fed, applies 60 to 70 rings with one loading. Rings are No. 16 gage wire, have a diameter and overlap of ¼ inch each. Developed for the armed forces for attaching strips of wire netting and fence wires, it is now available in limited numbers to vital civilian industries. Bostitch, 139 Division St., East Greenwich, R. I.



"Out of another world" comes an amazingly better Liquid Handling Pump

To look at it you wouldn't see much to "ah-h" about.

It's small. Weighs less than 4 pounds. But when you note its capacity . . . its efficiency curve . . . its performance record . . . then you begin to take notice.

You see, we designed this pump for operation in another world, high in the heavens . . . in rarefied, subzero atmospheres . . . for planes demanding fuel to maintain speeds of five miles per minute and better.

Pesky things can, and did, happen to pumps up there. But no more . . . since we perfected engine-driven pumps with relief and by-pass valves that maintain efficiency regardless of temperature . . . since we perfected fuel pump refinements which handle "dry" high-octane aviation gasoline at close to 100 per cent volumetric efficiency . . . since we developed a motor-driven booster pump with a new impeller which is approximately 20 per cent more efficient on a power consumption basis than any other now in use on centrifugal pumps of equivalent size.

By mastering these and many other aircraft pumping problems, PESCO can give you fluid handling equipment of entirely new performance. Equally improved PESCO equipment is also adaptable for all types of pumping needs; hydraulic, air, vacuum and liquid. May we tell you more about PESCO Pumps and PESCO Engineering Service?

SEND FOR THIS BOOK "Pressurized Power and Controlled Flow by PESCO". This book pictorially tells the story of PESCO equipment, manufacturing facilities and engineering service. A copy will be mailed promptly upon request.

WRITE TO . . .
PESCO Products Co.
Industry Service D
11610 Euclid Avenue
Cleveland 6, Ohio

Division Borg-Warner

In Precision Hydraulics, Fuel Pumps, Air Pumps, Related Accessories . . .
PERFORMANCE POINTS TO Pesco FIRST

Production Machines "Fly Close Formation" Straight to their objective

... WITH THE HELP OF VEEDER-ROOT COUNTING DEVICES

Veeder-Root INCORPORATED HARTFORD, CONN.
TRADE MARK REG. U.S.A. PAT. OFF.
FORM W-6 35-6-1
MADE IN BRISTOL, CONN., U.S.A.
U.S.A. PAT. NO. 2040025, 2040026, 2040027, 2153314
OTHER PATS. PEND.

You can prevent stragglers and lame ducks in any machine department . . . by the simple, quick installation of a Veeder-Root Counting Device on each machine. Then you will have a complete set of up-to-the-minute facts in figures that will warn you when any machine begins to get behind schedule . . . so that you can make repairs or adjustments immediately, before a shortage of parts ties up final assembly.

And you can gain other advantages, too. For example, the Predetermining Counter shown above will free operators from the necessity of watching a high-speed run, so that they can attend to other work. All they have to do is set the predetermining figure-wheels to the number of turns, strokes or pieces required . . . and start the machine. When the run is completed, the counter acts to stop the machine or signal the operator by light or bell. Find out in how many different ways Veeder-Root Devices can help make your production count for more than ever before. Write to the "Counting House of Industry."

Veeder-Root Inc.

Hartford 2, Conn.

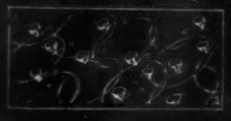
In Canada: Veeder-Root of Canada, Ltd., Montreal
In England: Veeder-Root Ltd. (New address on request)

1st to finish!

Faster... more precise on wood, metal or plastics than hand or ordinary machine sanding!

STERLING
1000 ELECTRIC PORTABLE
SANDER

TIME IT YOURSELF! Compare Sterling sanding with the method you are now using. Ask for free demonstration!



ORBITAL MOTION of the sanding pad on the Sterling 1000 moves thousands of abrasive grits in 3/16" circular orbits against the work at a speed of 4500 oscillations per minute! Assures faster... more uniform sanding.

The Sterling 1000 covers the entire range of abrading from coarse sanding to lapping and finishing... curved or flat surfaces. Vibrationless... easy to use... precise in operation. Important additional features described in new Sterling booklet. Write for your copy today!

For air-driven sanding ask about the Sterling Speed-Bloc Sander!

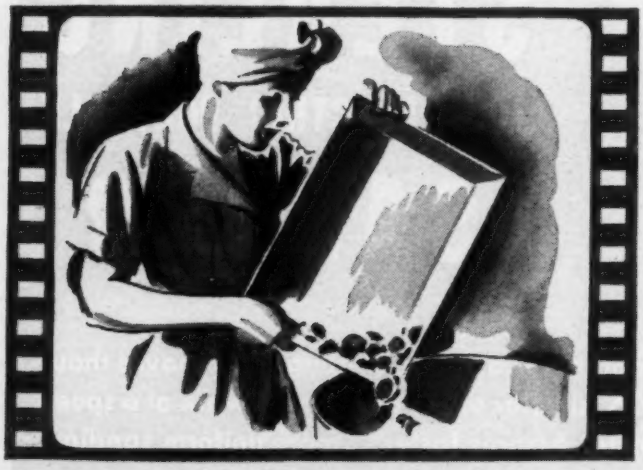
STERLING TOOL PRODUCTS CO.

390 EAST OHIO STREET • CHICAGO 11, ILLINOIS

Los Angeles and Toronto

A SIMPLE CHANGEOVER *Cheats the Scrap can*

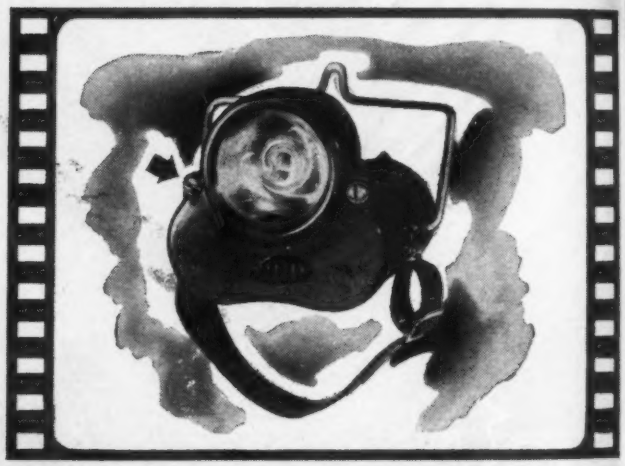
A CLOSE LOOK at assembly methods paid the Flashlight Company of America handsomely in lowered production costs on Rist-lites. They found a surprisingly simple way to save plastic parts, work-hours, and tools on a job that had proved unusually troublesome.



EXPENSIVE SPOILAGE had been the grist of each day's operation. The plastic frequently cracked in tapping. Threads were stripped and crossed in fastening covers with machine screws. Scrapping of plastic cases ran high, and tap breakage often occurred in tapping the blind holes.

SELF-TAPPING SCREWS FOR EVERY METAL AND PLASTIC ASSEMBLY

THE SIMPLER P-K METHOD, fastening with Self-tapping Screws, was proved practical for this job by a P-K Assembly Engineer. The P-K Type "Z" Screw he recommended *forms* a thread as it is turned into a plain, untapped hole, and makes a *stronger* fastening than the machine screw it replaces.



A THREEFOLD SAVING . . . in tapping expense, tap breakage, and parts breakage was the reward of this manufacturer's decision to "Question Every Fastening". You can make similar savings in 7 out of 10 jobs, plastics or metal, when you put the simpler P-K fastening method in your assembly picture.

Ask for a P-K Assembly Engineer to call and help you search out all opportunities to gain work-hours, save material, improve products with Self-tapping Screws. Or send assembly details for recommendations. Parker-Kalon Corp., 196-200 Varick St., New York 14, N. Y.

PARKER-KALON

Quality-Controlled

SELF-TAPPING SCREWS

Like automobile tires, mine locomotive wheels wear out. New wheels are hard to get, expensive, require critical steel.

"Retreading" ... WITH STEEL

By welding layers of steel to the worn wheel, then machining this "retread" to the standard tire contour, badly worn locomotive tires—and axles too—can be reclaimed.

Wartime steel shortages, and the pressing need to keep equipment running, has greatly increased the need for this maintenance service.

Westinghouse District *Manufacturing & Repair** Plants in the nation's coal mining areas have more than doubled their facilities for handling this vital emergency service.

Every Westinghouse M & R Plant is a part of a nationwide service organization—with local branches as close as your telephone. Factory trained men, using factory methods and equipment, are ready to give you complete, dependable repair service on any type of electrical equipment. J-90501

When vital electrical equipment needs repair . . . phone the nearest office of Westinghouse Electric and Manufacturing Company for

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PLANTS IN 25 CITIES... OFFICES EVERYWHERE

COMPLETE REPAIR SERVICE

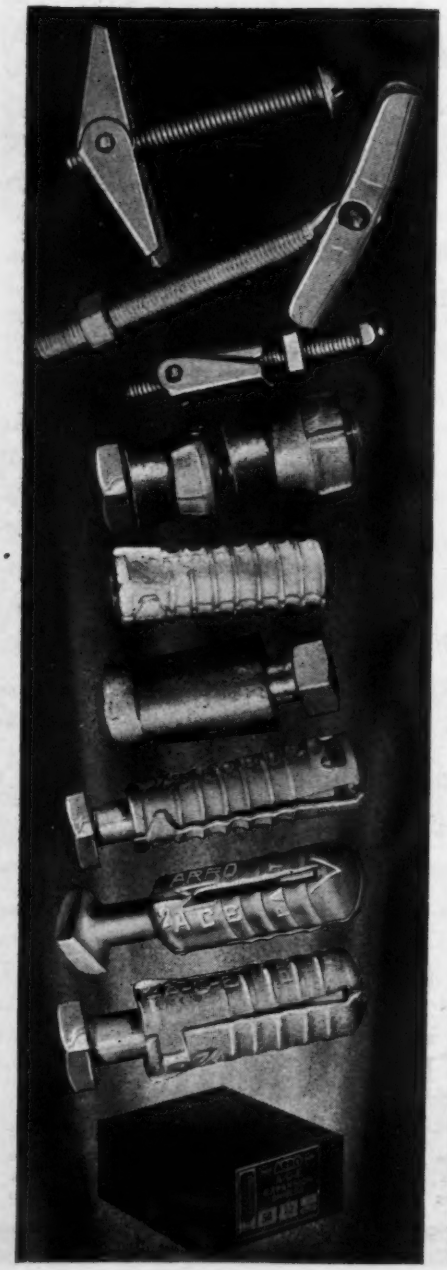
*33 M & R PLANTS • • ONE NEAR YOU

TRADE ARRO MARK

EXPANSION BOLTS
AND ALLIED PRODUCTS

Now, as in the past, are your logical choice for the reconversion of plant and machinery.

Sold only through distributors with ample stocks on hand.



Significant Labor Developments

Period Surveyed: January 10 to February 10

TREND INDICATORS

Walsh-Healey Interpretations Revised

THE PUBLIC CONTRACTS DIVISION has revised its interpretations of the Walsh-Healey Act, conforming them to those issued under the Wage-Hour Law, with respect to the exemptions for executive, administrative, and professional workers, the exemption for seamen, and the partial exemptions for learners and handicapped workers; the computation of hours of work and overtime pay; the employment of minors; and deductions from wages. These interpretations are for all contracts awarded as a result of invitations issued or negotiations commenced after March 1, 1944.

Truck Drivers' Overtime Pay Under Walsh-Healey Act

Although the new interpretations issued by the Public Contracts Division in general brought rulings under the Wage-Hour and Walsh-Healey Acts into closer conformity, they have a contrary result with respect to overtime pay for certain truck drivers, who might be exempt under the Wage-Hour Act. Truck drivers employed by a firm engaged in the manufacture of products under a government contract are considered subject to the Walsh-Healey Act if they:

1. Haul to the plant materials or supplies to be incorporated into or used in the manufacture of the contract products
2. Haul intraplant supplies or materials or the contract commodity
3. Haul the contract commodities to the government or the destination it has designated.

Truck drivers employed by common and contract carriers are not subject to the Walsh-Healey Act.

One-Thousand-Hour Exemption

The Wage-Hour Act permits employment up to 12 hours daily and 56 hours weekly without payment of overtime rates for employees covered by a union contract under which no more than 1000 hours may be worked in any period of 26 weeks. However, an employer must conform in all respects with the requirements of the Act, if his employees are to be partially exempt from the overtime pay provisions of the Act. A court held invalid a contract which provided that no employee may be employed more than 1000 hours in 26 consecutive weeks beginning with the effective date of the contract, and that there would be a second such period following the first. It also provided that the employer may suspend any employee during any week in which he has worked the maximum 56 hours. The contract specified one particular period instead of any period of 26 weeks, and did not provide for payment of time and one-half for work in excess of 12 hours daily or 56 weekly. (Cabunac et al. vs. National Terminals Corporation, CCA-7)

Held Under the Act

A watchman employed to reduce insurance rates to the company. The Court held that the fact that a fire insurance company was willing to reduce its premiums to a company engaged in production for interstate commerce if a watchman were kept on guard, was sufficient evidence to show that the watchman's work was necessary to the production of the goods. (Walter vs. Southern Package Corp., U. S. Sup. Ct.)

A watchman employed by a drydock company to guard its pier and interstate barges tied up to the pier awaiting repairs, since the barges are "goods" within the meaning of the Act, and the repairs constitute production. (Slover vs. Wathen, CCC-4)

Salary as an Essential Factor in Exemptions

While agreeing that the most pertinent test for determining an employee's executive or professional status is the duties he performs, the Circuit Court of Appeals ruled that the salary test also is a pertinent criterion, and its inclusion in the definitions is neither irrational nor unreasonable, since persons employed in such capacities are generally higher paid than those who work under their direction and supervision. (Walling vs. Yeakley, CCA-10)

Held Hours Worked

A federal district court ruled that all hours spent by employees in "learning by doing" are compensable hours worked, where the employer benefits by their work. In this case, the employer could not avail himself of the learner exemption, since no learner certificate had been issued. (Walling vs. First National Bank of St. Charles, Minn., USDC Minn.)

Including Piece-Rate Bonus in Regular Rate

A federal district court decided that wages computed on a piecework basis are a part of the regular compensation, in addition to the base rates, and that an employer violated the overtime requirements of the Wage-Hour Law by failing to include a piece-rate bonus in computing the employees' "regular rate of pay." Designating the "base rate" as the "regular rate" did not make the contract a valid one under the

TITANS of the Floorways

Each of these three *Finnells* is *titanic* in its floor-cleaning capacity . . . in its power to save man-power for war-power!

The *Finnell* Combination Scrubber-Drier shown in center illustration is a self-powered (cableless) model for use in ultra-vast war plants. It has a cleaning capacity up to 15,000 sq. ft. of floor per hour. Translate that into man-hour savings and it means that this *Finnell*, which scrubs and dries the floor *in one operation*, can clean in approximately one man-hour a floor area that formerly required seventeen man-hours! Independent of power lines, the machine is free to go wherever the operator guides it. Has gasoline engine.

Illustration at top shows a *Finnell* Industrial Dry Scrubber,—*titanic* in its power to dig through and remove heavily packed-down accumulations of dirt, oil, grease, and shavings. Ten times faster than hand-spudding!

At bottom of the above group is shown an electrically-driven Combination *Finnell*. The one machine scrubs, rinses, and dries the floor . . . and can clean a floor area the size of a city block in less than eight hours!

For free floor survey, consultation, or literature, phone or write nearest *Finnell* branch or Finnell System, Inc., 2503 East Street, Elkhart, Indiana.

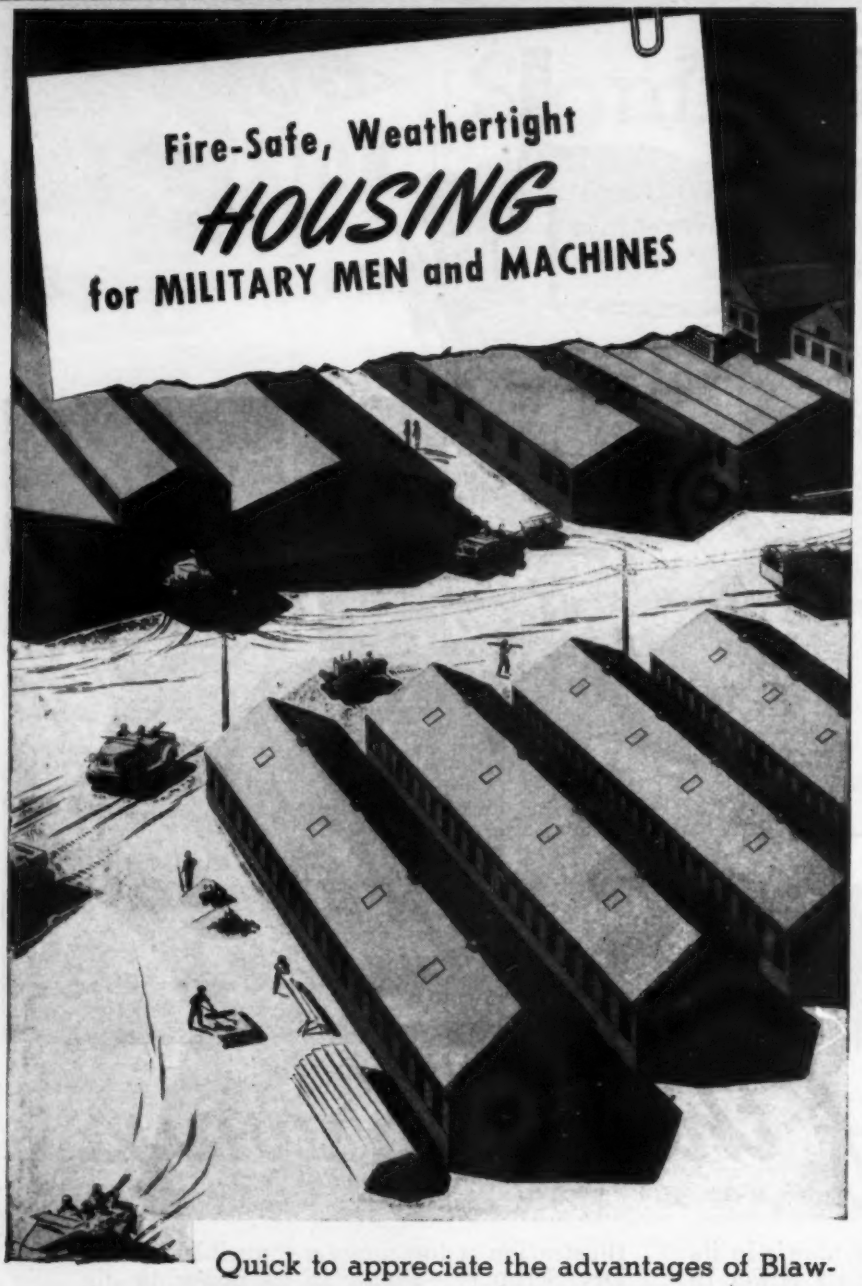
Let's All Back the Attack — With War Bonds

FINNELL SYSTEM, INC.

Pioneers and Specialists in

FLOOR-MAINTENANCE EQUIPMENT AND SUPPLIES

BRANCHES IN ALL PRINCIPAL CITIES



Quick to appreciate the advantages of Blaw-Knox Standard Steel Buildings was the S.O.S. In hundreds of camps and depots they're providing storm-proof shelter for our armed forces, their shops, equipment and ammunition both here and abroad. If engaged in war work call on Blaw-Knox now to take over the problem of adequate "coverage" for your expanding facilities.

ARMY NAVY

BLAW-KNOX STANDARD STEEL BUILDINGS
BLAW-KNOX DIVISION of Blaw-Knox Company

2031 FARMERS BANK BUILDING, PITTSBURGH, PENNSYLVANIA
NEW YORK CHICAGO PHILADELPHIA BIRMINGHAM WASHINGTON

Belo decisioin. The Court held that the Belo decision did not mean that, after the parties had worked out and agreed upon the compensation to be paid, they could then agree what the "regular rate" would be for overtime purposes. (Walling vs. Harnischfeger Corp., USDC E, Wis.)

Partial Settlement Upheld

Where there was doubt as to whether the employees were subject to the Act, the court approved a settlement for 35 percent of the alleged unpaid overtime wages as valid under the Wage-Hour Law. The approval was restricted, however, to those employees who had given their written approval and agreed to accept the amounts specified in their consents. (Schnell vs. Park-Lexington Company, Inc., USDC, SD, NY)

Review of Wage Order

An employer who believes that a wage order issued by the Administrator adversely affects his legal rights, should seek a court review of this order within 60 days after its promulgation, otherwise he may not contend that the order is inapplicable to him when the Administrator later brings suit against him to compel compliance. (Walling vs. Cohen, CCA-3)

WAR LABOR BOARD

** Merit Increases Under Order 31*

WLB has interpreted the restrictions of General Order No. 31, which limit the total amount of merit and automatic length-of-service increases to:

1. Ten cents per straight-time hour, or two-thirds of the difference between the appropriate minimum and maximum rates for any individual employee during any year; and
2. An average of 5 cents per straight-time hour a year for all employees in the establishment subject to the plan.

These limitations, the Board states, may not be applied to permit general wage increases for all employees or for major groups of employees. The employer may not, for example, set aside an amount representing 5 cents for each man-hour to be worked during the year and then, after refraining from granting any merit raises during the first half of the year, grant a full 10-cent hourly raise to all employees in the second half of the year. The 5- and 10-cent limitations must be applied to the average straight-time hourly rates, regardless of the time the adjustment takes effect.

** Reduced-Price Stock Sales as Salary Raise*

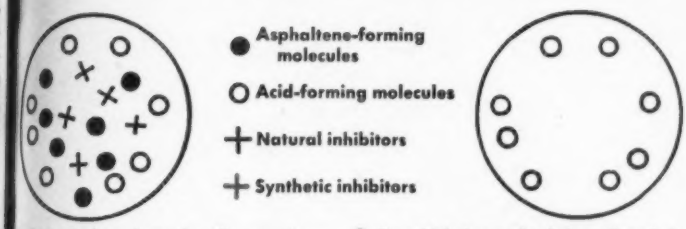
Below-market sales of stock to employees who receive dividends thereon constitute salary adjustments which require approval.

In order to obtain approval the employer should show, among other things, the extra income the employees may expect as a result of the plan, the past earnings records

* In this and the following classifications items marked with an asterisk also are considered to be trend indicators.

The function of inhibitors in Nonpareil Turbine Oil

The prevention of oxidation



1. Certain hydrocarbons in oil must be removed or rendered harmless, because they tend to oxidize and form asphaltenes or acids, with resultant deposits, corrosion, and emulsions. Natural inhibitors present in the oil may retard acidity development.

2. By a *high degree* of refining, all asphaltene-formers can be removed, but at the cost of also removing the natural inhibitors and leaving the oil without protection against acidity formation.

3. Most turbine oils are, therefore, a compromise—some of both the asphaltene-formers and inhibitors are removed, but *not all* of them, and few of the acid-formers. As a consequence, some deposits and sludge are formed.

4. In making Nonpareil Turbine Oil, we remove *all* asphaltene-formers, even though the inhibitors go out with them. We can do this, because we replace the natural inhibitors by a synthetic inhibitor which renders the acid-formers harmless.

The refining process in combination with the patented inhibitor in Nonpareil explains why sludge is never a problem to users of Nonpareil . . . also, why acidity generally remains at about 0.05 (neutralization number) and is guaranteed never to exceed 0.15.

Corrosion problem also solved

• THE LATEST Nonpareil Turbine Oil development is the discovery of a corrosion inhibitor which prevents both types of corrosion found in turbines today. These are common rust (Fe_2O_3), found in storage tanks above the oil level or in depressions and pockets in the system where water accumulates, and magnetic iron oxide (Fe_3O_4), caused by water in suspension in the oil and found in all parts of the oil system. The latter forms dense hard crystals which are highly abrasive and which can clog oil lines and stick governors in short order.

Nonpareil Turbine Oil has contained a corrosion inhibitor since 1926; and corrosion prevention has been under continuous study in our laboratories.

Hundreds of tests were made with scores of products having rust-preventive properties. Some were excellent from an anti-rust standpoint but could not be used because of their poor demulsibility and other properties which would impair the desirable qualities of Nonpareil.

From these tests emerged one thoroughly satisfactory product which has now been completely tested and incorporated in Nonpareil. With this, and the patented oxidation inhibitor, Nonpareil gives complete freedom from both troublesome corrosion and deposits.

You'll want to learn more about this interesting development. Send for a Standard Lubrication Engineer. He'll be glad to supply full test data and service records. Call any Standard Oil Company (Indiana) office, or write 910 S. Michigan Ave., Chicago 5, Ill. In Nebraska, address Standard Oil Company of Nebraska at Omaha 2.

NONPAREIL TURBINE OIL

Oil is Ammunition . . . Use it Wisely

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

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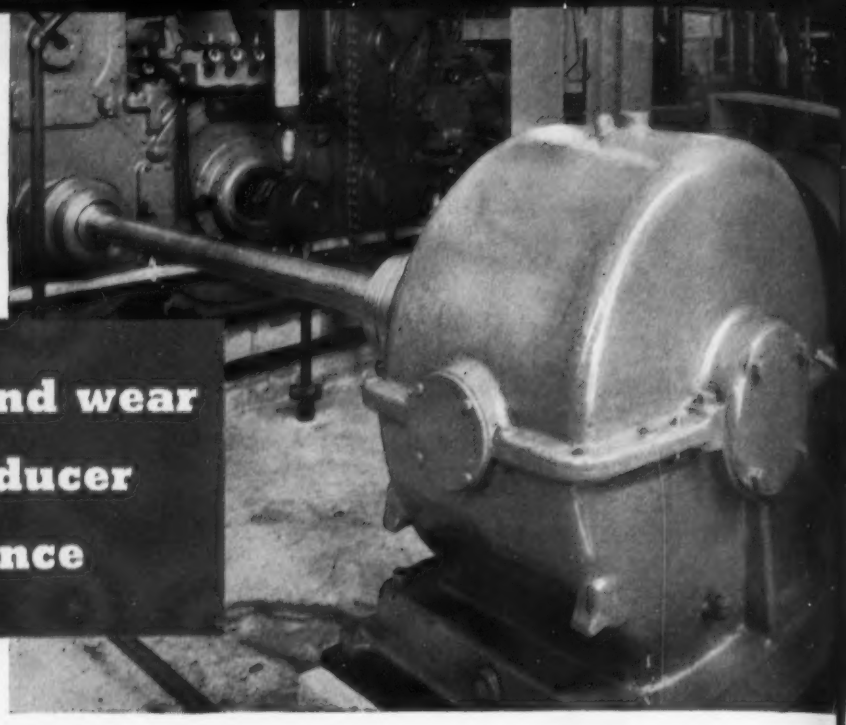


Avoid work and wear in speed reducer maintenance

Barring mechanical faults in equipment, the right oil will help avoid numerous difficulties which haunt overworked speed reducers or bath-oiled gears—particularly deposit, emulsion, foaming and starting troubles. If you find it necessary to clean gear cases or change oil in them frequently, or if you find too much gear wear, it should pay you to review your oil requirements.

Look into the qualities of Stanoil. Many operators have found it ideal for these services. Why it has proved so effective is discussed in the "trouble" and "cure" columns at the right.

Let a Standard Lubrication Engineer help you test the right grade of Stanoil. Call the nearest Standard Oil Company (Indiana) office, or write 910 S. Michigan Ave., Chicago 5, Ill., for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska at Omaha 2.

Oil is Ammunition . . . Use it Wisely

★ STANOIL ★

★ ★

Causes of oil trouble in speed reducers

Deposits. Under heat and agitation in the presence of oxygen, some oils oxidize—that is, certain unstable hydrocarbons undergo a chemical change. Some form asphaltenes which settle out of the oil. Others form acidic substances which attack certain metals, and form metallic soaps. Both cause deposits which may clog oil passages and lead to excessive wear on bearings and gears.

Emulsions and foaming. Acidity also reduces the demulsibility of oil. Any moisture that enters gear cases through leakage or condensation, will mix with the oil and form an emulsion—particularly if dirt or foreign matter is present. This reduces the oil's lubricating quality, causes foaming and may also cause clogging of oil lines.

Hard starting. This trouble occurs most frequently where speed reducers must operate under widely varying temperatures. These units may be warm enough when running to require a fairly heavy oil. But the same oil, at cold starting temperatures, is usually stiff—it boosts power demands. Units may refuse to start at all until heated. When lighter oils are used, starting is easy, but as the temperature rises, most light oils thin out excessively, and cannot give proper protection under load.

How Stanoil helps avoid them

High stability. The problem in producing an oil that reduces deposits is to remove the unstable hydrocarbons—those that unite readily with oxygen. This has been accomplished in Stanoil by a unique refining process. Stanoil has high stability against oxidation. Frequent oil changes made necessary because of high oil acidity, or gear case cleaning to remove deposits, are materially reduced with Stanoil.

Good demulsibility. The high oxidation stability of Stanoil gives it great resistance to acidity formation—one reason why Stanoil does not emulsify readily with water even in the presence of dirt. Also, Stanoil separates easily from water and may be used for long periods without emulsion or foaming trouble.

High viscosity index and low pour test. The combination of these qualities is needed to eliminate starting troubles. High V. I. prevents excessive thickening at low temperatures, and excessive thinning out at high temperatures. Low pour point prevents oil flow stoppage caused by paraffin wax formation. All grades of Stanoil have this combination of qualities in very high degree. That is why the same grade of Stanoil helps cold speed reducers to start more easily, yet gives perfect lubrication under high operating temperatures.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

of the employees involved and the primary purpose of the stock purchase.

*Increase to Maintain Differentials Awarded

The Commissioner of Internal Revenue has authorized tapered salary increases for supervisory employees in anthracite coal mines to restore the minimum differentials between their earnings and those of production workers recently increased by WLB awards. The increases are made retroactive for the period between May 1 and November 3, 1943, and are limited to those earning not more than $600 a month.

Salary Stabilization Unit Percentage-Type Pay Rule

Effective retroactively for 1943 and applying to 1944 and subsequent years, SSU permits employers to make percentage-type payments, such as bonuses, commissions, etc., without prior approval provided there has been no change since October 2, 1942, in either the percentage method of computation or the employees' base salary. Approval is *not* required to make supplementary payments to adjust 1943 earnings to this new rule.

*SSU Vacation Pay Rules

Vacation pay for employees within the jurisdiction of the Treasury must be limited to amounts equal to their earnings for a normal, unextended work week, even though work schedules have been increased, for example, by the operation of the 48-Hour Week Order. This is contrary to the principle of WLB, which authorizes its regional officials to approve the payment of vacation pay based upon straight-time compensation for lengthened work weeks.

*Overtime Pay for Administrative Employees

Employees who receive salary increases which qualify them for administrative or professional exemption from the Wage-Hour Law, and so move them from the jurisdiction of WLB to that of the Treasury, may not receive overtime pay without prior SSU approval, unless it was the employer's practice to pay other similarly exempt employees for their overtime. However, the salary criterion is only one of the requirements for exemption from the Wage-Hour Law, and if employees do not meet all of them, they must receive overtime pay no matter how high their salaries may be.

Substandard

WLB approved a 50-cent hourly minimum to correct substandard wages plus tapered wage raises based on the substandard wage adjustment to 70 cents an hour. (Six Philadelphia Leather Goods Manufacturers, WLB)

*Application of Little Steel Formula

WLB reversed its own prior decision, applying the 15 percent rule to one bargaining unit of a company, and directed that the Little Steel formula be applied on a

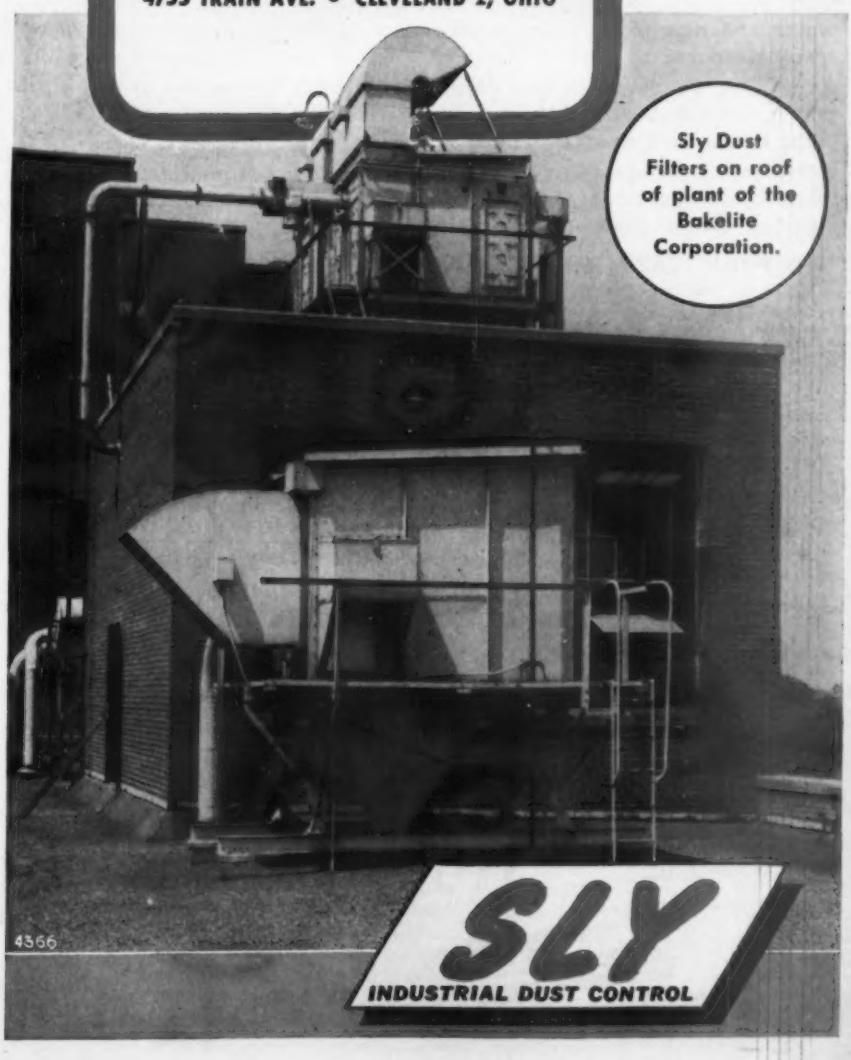
SLY
KEEPS THE AIR LANES FREE FROM DUST— AT BAKELITE'S PLANT

SHOWN below are two of the four Sly Dust Filters on roof of the Bakelite Corporation plant—two on the penthouse and one at each end.

Dust-laden air, created in manufacturing operations, is drawn through ducts into these filters and all dust is removed, keeping the plant clean and providing healthful working conditions for employees.

More and more plants are installing Sly Dust Control. It is not expensive, costs little to operate and pays big returns in quality of product and character of workmanship due to improved working conditions. Ask for Bulletin 98 and tell us your problem. Our engineers will help you solve it.

THE W. W. SLY MFG. CO.
4755 TRAIN AVE. • CLEVELAND 2, OHIO



Sly Dust Filters on roof of plant of the Bakelite Corporation.

Carey PRODUCTS KEEP 'EM WORKING!

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company-wide basis. Its earlier ruling, the Board held, would have disturbed established wage differentials and created inequities, since the lower-paid employees would have received a smaller dollar increase than the higher-paid workers. (Pacific Telephone & Telegraph Co., WLB)

High Wage Scale for Rare and Unusual Case

WLB will approve a scale of wage rates above the minimum going rates in the area when the case is a rare and unusual one involving critical war production. Such factors as the necessity of recruiting personnel for a completely new plant expected to employ several thousand workers, the high military priority of the product to be manufactured, and the fact that employment in the plant is to be only temporary, have put a case in the "rare and unusual" category. (A. O. Smith Corporation, RWLB-VI)

Compensating Increase Denied

A Regional Board denied a pay increase to pieceworkers or incentive workers whose earnings had decreased almost 15 percent because of a drop in production which was the result of causes beyond the employees' control. The Board felt that to grant such a request might lead to evasion of the stabilization policies by collusive company-union agreements to reduce production long enough to obtain compensating wage adjustments. (Erwin Cotton Mills Company, RWLB-IV)

Miners' Travel Pay Denied

A federal district court denied the miners' claims for underground travel time pay under the Wage-Hour Law, stating that the company satisfied its obligation under the Act by paying its underground miners only for time actually worked. WLB's approval of the settlement made out of court of the travel-time issue between Secretary of the Interior Ickes and the United Mine Workers depended on whether the travel time should be considered working time under the act. (Jewell Ridge Coal Corporation vs. United Mine Workers, Local 6167, USDC, W. Va.)

* *Escalator Clause Permitted*

A union will not be deprived of an acquired standard by the elimination of escalator clauses from current union contracts. However, the new contract must provide that the clause will not be construed as requiring payment, either now or at a future date, of any amounts not presently permissible under national wage stabilization policies. (Publicker Commercial Co., RWLB-III)

Past Differential Continued

WLB has no authority under the Wage Stabilization Act to eliminate a customary differential, if its elimination results in a reduction of the indivdual employee's rates. (Ford Motor Corporation, RWLB-XI)

* *Bonus Policy for Rotating Shifts*

Generally, the test for determining whether a bonus should be granted to rotating shift employees is whether the inconvenience of

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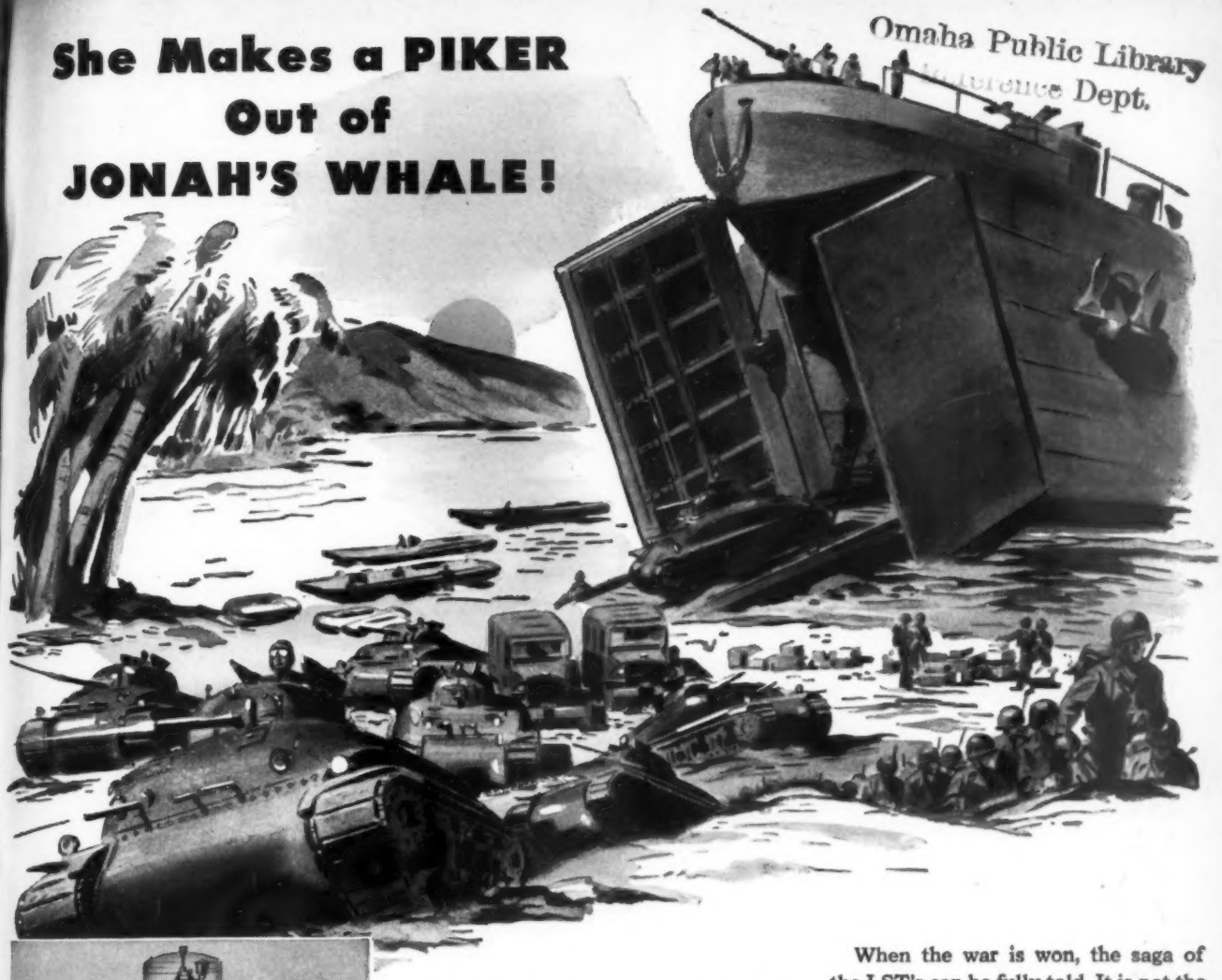
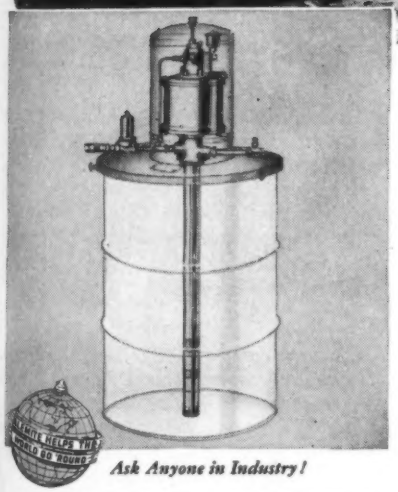
She Makes a PIKER Out of JONAH'S WHALE!





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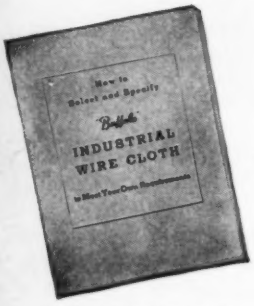

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BASKETS for Annealing, Dipping, Conveying, Handling, etc. Bulletin 595

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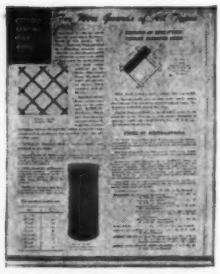

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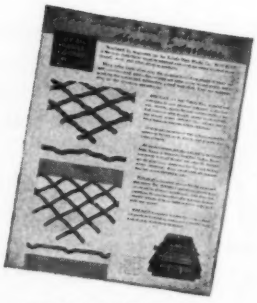

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the periodic night work was considered at the time the basic wage rates were established. A Regional Board applied this principle to award a shift bonus where it found that the inconvenience factor had not been considered in establishing the basic rates, since only part of the employees were required to work on the night shift, but no differential existed between their rate and that of the rest of the employees. (American Stove Company, RWLB-VII)

Bonus Discontinued

WLB will refuse to order the continuance of year-end bonuses where there is a reasonable doubt that they are an integral part of a company's wage structure. Companies were permitted to discontinue bonuses where past bonuses had varied in amount and had been omitted in two years (Libbey-Owens-Ford Glass Company, RWLB-V), and where the company had paid a bonus only once before. Neither constituted "repeated voluntary action on the part of the company," one of the Board's criteria for determining whether the bonus had been incorporated as part of the wage structure. (Line Materials Company, RWLB-V)

* *Incentive Plan Rulings*

WLB stresses close adherence to carefully set engineering standards in determining whether a proposed incentive plan is in compliance with the stabilization program. These basic points have been emphasized.

1. Provision should be made for readjustment of rates whenever basic changes occur either in the methods or means of production which are unrelated to the employees' activities or efforts.
2. In resetting old rates or in setting new rates, past earnings are not necessarily controlling.
3. The primary objective in readjusting rates is to afford the same earnings opportunity for similar skill and effort.
4. New rates should not be set so as to guarantee past average earnings when in the past there was no guarantee.

* *Attendance-Incentive Bonus Approved*

WLB approved an attendance-incentive plan which provided for a 1 percent bonus for each 1 percent increase in output above a production standard representing the company's average output during a preceding 12-month period. The percentage is up to, as well as above, the standard 48-hour week, provided such hours do not exceed 3 percent of the total payroll hours. An employee unjustifiably absent four days during the month loses his entire bonus. Absence for one day without cause brings a 20 percent reduction; two days, a 45 percent reduction, and 3 days, a 75 percent reduction. (Potash Company of America, WLB Nonferrous Metals Comm.)

* *Going-Wage Minimum for Incentive Workers*

A Regional Board ordered the minimum of the going wage bracket to be used as a guaranteed wage for incentive workers. This would leave both the employees' base

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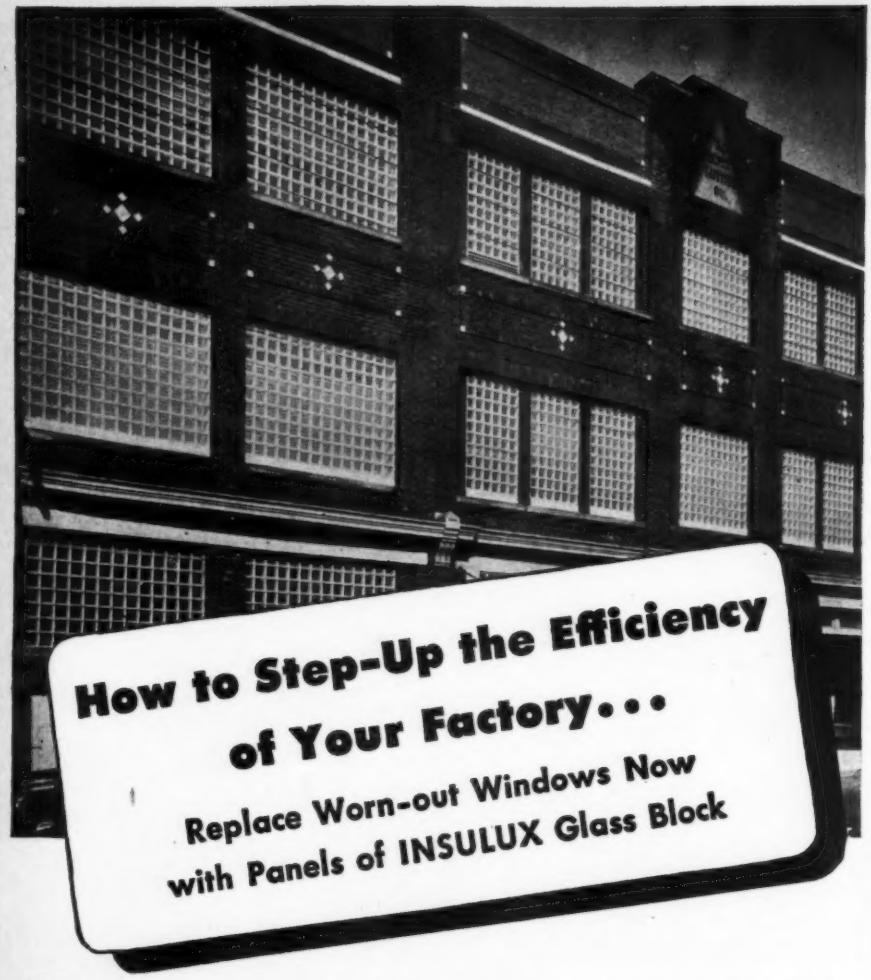

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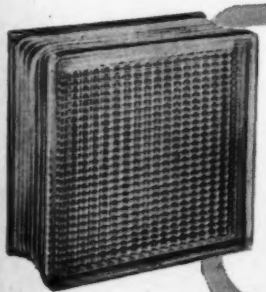

If you have a plant where sash replacement presents a problem, you need this book. It contains photographs, drawings, and specifications for all types of buildings and conditions. Write today for your free copy of this helpful, money-saving handbook. Owens-Illinois Glass Company, INSULUX Products Division, Dept. 116, Toledo, Ohio.

rates and the average hourly earnings substantially undisturbed, but would create a new minimum above the base rate equal to the minimum of the going wage bracket. For example, an employee working on a job having a base rate of 70 cents an hour may actually earn $1 an hour under the incentive system. If, for instance, the minimum going wage rate for the job is 80 cents an hour, the employee would, under the Board's order, always be guaranteed the 80-cent minimum rate, but would continue to receive higher hourly earnings under the incentive plan, provided he maintained his previous production standard. (Swartzbaugh Manufacturing Co., RWLB-V)

* *Incentive Bonus for Non-Production Workers*

WLB approved a plan whereby for each 2 percent increase in the efficiency of production workers above a given standard, a bonus of a little less than 1 percent would be paid to non-production workers who service the production workers. In this case, it was shown that the amount of work performed by non-production workers increased with the increased efficiency and output of the production workers, and that the proposed plan would result in a reduction in unit labor costs. (Westinghouse Electric & Mfg. Co., WLB)

Incentive Plan Disallowed

The Board ordered a company to employ a firm of consulting engineers to make a complete analysis of an incentive plan now in effect, and to negotiate with the union on possible changes. The present incentive system had never been understood among incentive workers, had created inequalities among incentive workers and between incentive and non-production workers, and had been so unsatisfactory from the worker's point of view that it had resulted in a number of recent work stoppages to the detriment of the war program. (Borg-Warner Corporation, WLB)

* *Holiday Premium Pay*

Payment of time and one-half for work done on one of the designated holidays, in addition to the straight time customarily paid if work is not performed is, in ordinary circumstances, a direct violation of the Premium Pay Order. However, the Order does not limit the amount of premium pay which may be given in special circumstances, such as call-in work, specially onerous or burdensome work, or emergency shifts. Therefore, if employees are called in to work at unusual hours outside their regular work schedule on one of the designated holidays, they may be paid *both* the time and one-half for their work and the straight-time which they would receive if they performed no work on the holiday. (Tidewater Associated Oil Company, Joint WLB-Labor Department Commission on Premium Pay)

* *Penalties for Wage Control Violations*

WLB is determined to assess full penalties against violators of the stabilization regulations. In one case, the *entire amount* of

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wage payments illegally increased was disallowed as an item of cost of the employer for purposes of income tax, price ceilings, and other government regulations. The employer was given adequate opportunity to refute or explain the violation charges. (Howard Menu Service, Inc., WLB)

In another case, the total amount of wages found to have been illegally increased was over $25,000, which was disallowed as an item of cost. As a result the company may be required to pay income tax from 40 to 90 percent of the amount disallowed, depending on its tax bracket. (Big Four Mills, Ltd., RWLB-V)

* *Interpretation of War Labor Disputes Act*

The government is not required by the War Labor Disputes Act to return seized properties to their owners within 60 days after restoration of pre-seizure productivity, but may retain possession as long as it is believed that return to the owners would bring the threat of a strike, according to the Attorney General. Productive efficiency cannot be regarded as restored if there is danger of future strikes. Otherwise, the purpose of the statute would be frustrated by rendering criminal sanctions against persons instigating strikes inapplicable at the very time they are most needed.

NATIONAL LABOR RELATIONS BOARD

* *Restricting Union Activities*

Employers may restrict the activities of employees engaging in pre-election campaigning, if the restrictions are reasonably necessary to preserve discipline and to safeguard production. However, all restrictions relating to activity on the employees' own time, even though on company property, are held to constitute interference. (Johnson-Stephens & Shinkle Shoe Company, NLRB)

* *Management's Duty*

NLRB held that it is the employer's duty to see that representatives of a union with which he has a contract do not abuse their contractual privilege of visiting the plant to transact normal union business by using such visits to campaign for the union. In setting aside the subsequent election, the Board stated that the employer could have adopted the alternative of granting similar privileges to the competing union. (Crocker-Wheeler Electrical Manufacturing Company, NLRB)

Discrimination

An employer who discharged an employee allegedly because of trouble with his foreman growing out of the employee's unstable temperament, was held guilty of discrimination where it was shown that his foreman had arranged a pay increase, and the employee was actively supporting a union opposed by his employer. (D. W. Onan & Sons vs. NRLB, CCA-8)

Held Not Discrimination

Although he did not follow the proper procedure, an employer was justified in

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Salt Lake City 1
Scranton 3

discharging a union steward who abused his position by disregarding work orders, urging other employees to slow down, and otherwise interfering with production. The employer should have followed the standard grievance procedure and told the union that the steward was going beyond the scope of his contractual privileges. Instead, the company offered him a supervisory job, and, when he turned it down, kept a record of his conduct to use against him if it should be charged with discrimination when it discharged him. (Badger Foundry Company)

* *Interference*

A union organizer's illegal arrest through the actions of plant guards did not constitute interference on the part of the employer, although the same organizer's illegal arrest, when caused by supervisory employees, did. (Standard Gage Company, Inc., NLRB)

Paying a bonus to strikers who returned to work, while withholding it from those continuing the strike, constituted interference. However, the Board could not require the employer to pay the strikers the bonus money which they would have received if they had not participated in the strike. (Fine Art Novelty Corporation, NLRB)

* *Held Refusal to Bargain*

Ordinarily an employer may refuse to recognize a union until its majority status is officially determined. But an employer was guilty of refusal to bargain collectively in such a situation, where he had previously recognized a union, since disappeared, which he had assisted in enlistment of members. NRLB rejected the employer's claim that an election was necessary in order to determine whether the union actually represented the majority of employees, since his assistance to the earlier union had affected the present union's standing. (Ibid.)

Refusal to Bargain

An employer may not lawfully refuse to bargain in good faith with a union over a wage increase merely because it is subject to WLB approval. (Ideal Leather Novelty Company, NLRB)

Held Not Willful Loss of Earnings

NLRB refused to remit any back pay where:

1. The employee, 58 years old, did not apply for a new job for 4 weeks after discharge where the plants in the area had a policy of not employing persons over 45 years of age, and the union during this time was seeking to obtain his reinstatement;

2. The employee left, after 3 weeks, a new job which involved transportation difficulties, and later secured some work and attempted to register with the United States Employment Service;

3. The employee applied unavailingly to five companies in the area for a job, as well as to the company which discharged him, and was led by his former employer to believe that he might be reemployed. (Greenville Steel Car Company, NLRB)

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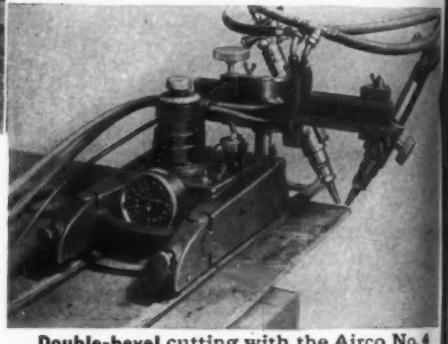
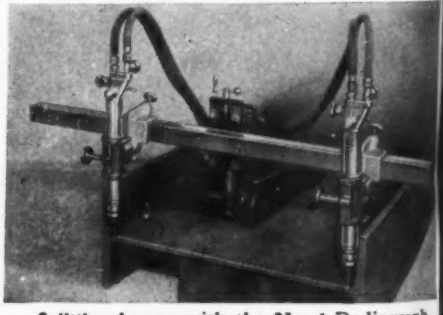


Double-bevel cutting with the Airco No. 4 Radiagraph to prepare plate edge for welding



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When you see this remarkable book we believe you will agree that its publication is further evidence of Dayton's leadership in the V-Belt field. If you have not received your copy, write for it today.

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THE DAYTON RUBBER MANUFACTURING CO.
DAYTON 1, OHIO

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V-Belts by Dayton Rubber

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One of several groups of Walker-Turner Drill Presses in the General Ceramics plant. These machines are used in drilling and tapping insulators of all types.

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At General Ceramics and Steatite Corporation's plant, Walker-Turner Machine Tools are used on a variety of jobs — in machining the Steatite insulators which this Company manufactures for the High Frequency Communication Equipment used by our Armed Forces.

Walker-Turner Machine Tools' *wide range of speeds* enables General Ceramics to select the optimum speed for their particular work. Their *accuracy* and *spindle stability* are important because Steatite is machined in its green, fragile condition before firing. And their *simplified design* and *easy operation* help this Company's many women workers turn out a greater volume of high-quality work.

In thousands of other war plants, also, Walker-Turner Machine Tools are doing a notable job in getting production "over the hump". Perhaps they are the answer to some of your machining problems, too. Send for catalog.

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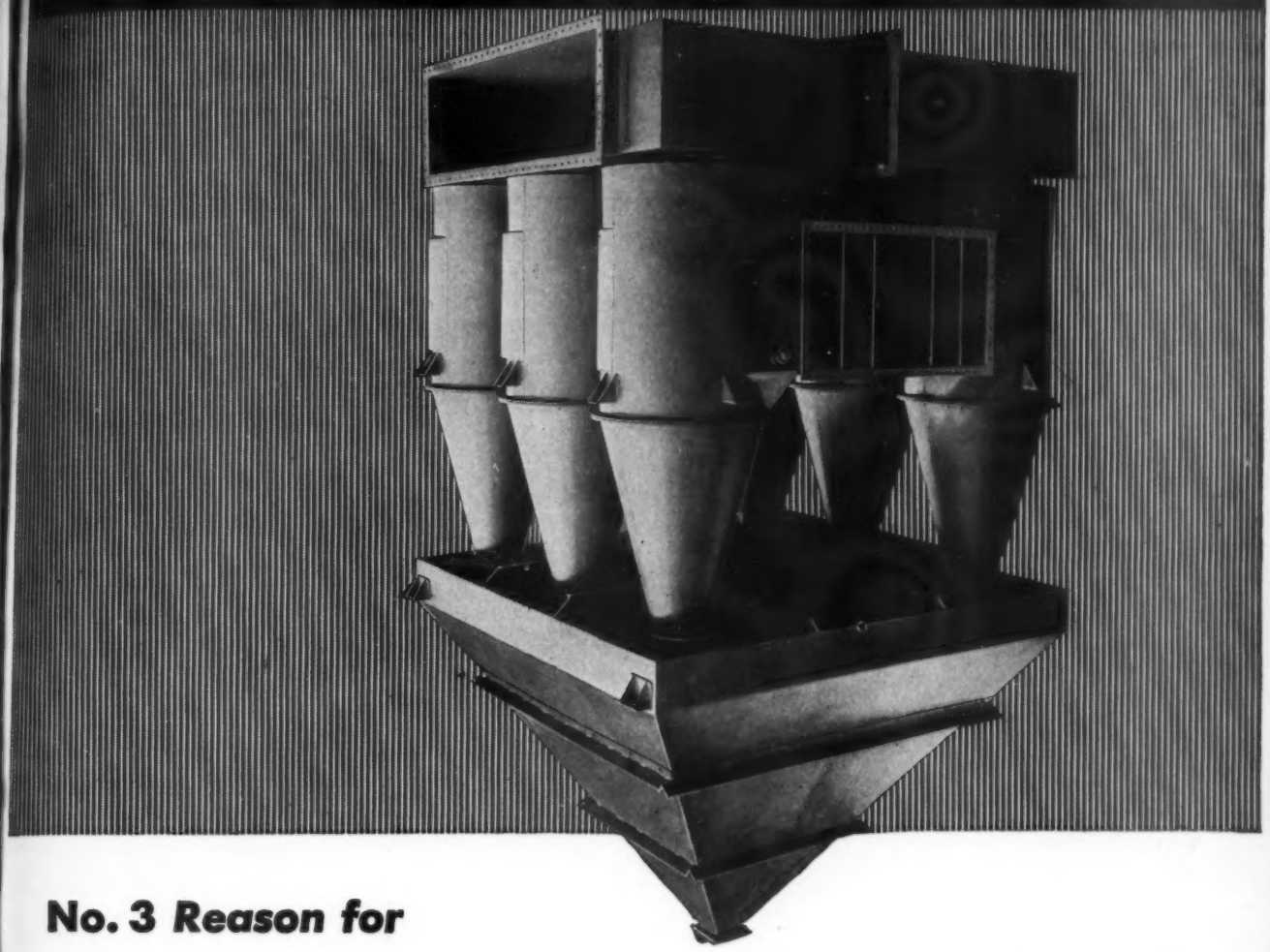

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To stand up under the severest conditions of continuous usage, cyclone bodies and cones in Buell Dust Recovery Systems are fabricated of extra-thick steel, rolled and welded into sturdy, one-piece construction to prevent springing of seams under high temperatures; while hoppers are braced and stiffened with 3" channels to resist vibration.

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How the patented "shave-off" of the van Tongeren cyclone (found only in Buell Dust Recovery Systems) makes it possible to use large diameters and, at the same time, obtain high collection efficiencies is fully described in a 28-page book: "The van Tongeren System of Industrial Dust Recovery." To secure a copy, simply write us for Bulletin G-842.

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BUELL FEATURES	RESULT IN	PRODUCE
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EXTRA-THICK METAL	LOW DRAFT LOSS	LOW OPERATING COST
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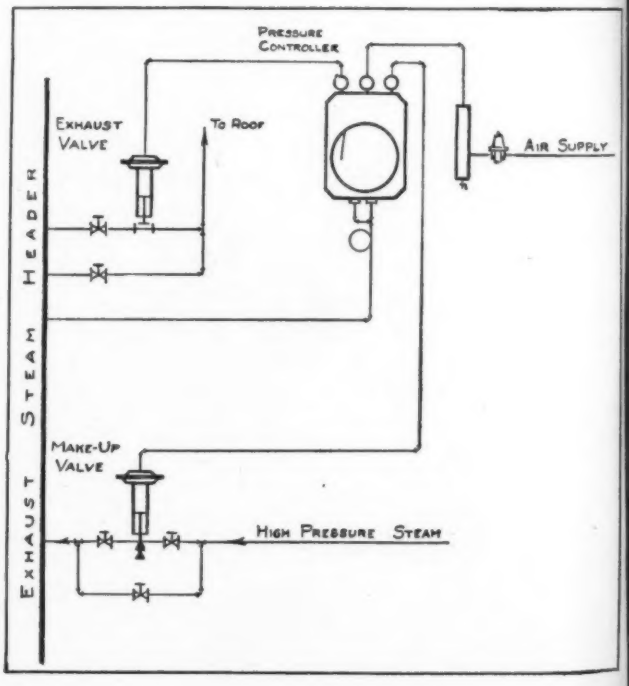

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The hose clamp can be installed by anyone in a few minutes, requires no special tools and can be used many times over. It has two grips—one on inside of hose, one on outside, a 2 to 1 advantage. Hansen **PUSH-TITE** hose clamp sockets are used by some of the largest plants in the world, where production records are being made almost daily.

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IT'S MOIST

IT'S FUMY

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The paint that really does a job where excessive moisture, temperatures or industrial fumes are present is available again. WPB regulations permit using aluminum paint in plant interiors where these conditions prevail.

For each of these troublesome maintenance problems aluminum paint, properly formulated for the job, has demonstrated that it provides longer lasting protection. Another way of saying it is lower maintenance cost. For other advantages you gain, see list at right.

It is possible under the current ruling to get aluminum paint for other purposes, too . . . even for purposes not specifically approved. Would you like to have a copy of the latest official WPB order M-1-g and further explanation of how it applies to you? Write ALUMINUM COMPANY OF AMERICA, 1983 Gulf Building, Pittsburgh, Pennsylvania.

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- High durability
- High reflectivity
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with war-swollen freight

You are looking at the world's largest classification yard.

Here, 8,000 cars a day, loaded with freight roll down the hump, are sorted and sent on their way to cities and hamlets across the breadth of the land.

These loaded cars rolling downgrade to the classification tracks would gain tremendous momentum were it not for the electrical retarders placed at intervals along the track. These retarders slow up the cars by gripping the wheel flanges with steel fingers.

Here is another job where Foote Bros. gears are working 24 hours a day helping get America's most important job—winning the war—done.

But the sturdy speed reducers—the compact actuators—the extreme precision gears that Foote Bros. are today producing for the Army, the Navy and for industry hold promise to American manufacturers of new efficiencies in the transmission of power made possible by new engineering developments—new manufacturing "know hows" acquired in the stern laboratory of war.

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Better Power Transmission Through Better Gears

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...the modern way to "know" what you're getting

A New England war plant, purchasing steel castings from an outside source, was experiencing a reject rate of 75% *after* machining. Each reject meant a loss of 3 machine and man-hours. Solution: X-ray inspection to "spot" defective castings *before* machining. Result: 100% real production from same men and machines . . . tremendous savings in materials. Another example of how Westinghouse X-ray takes the "guesswork" out of industrial inspection . . . speeds production and cuts costs.

J-02022

More Information? *See page 56*

Westinghouse
X-RAY
PLANTS IN 25 CITIES...OFFICES EVERYWHERE

THEY SAY AND DO

1944—Year of Trial

"From time to time during the months of the past year, there have been periods when it seemed to many in management and labor that we were on the threshold of victory. It should be clear to all of us now that such an impression was a false one, that before the threshold to peace is crossed, terrific obstacles will have to be surmounted.

"In our industrial war effort we have arrived at the stage where money can no longer be the principal incentive for human effort...the only incentive can be victory and the saving of lives of millions of America's young men. The job today of administering industrial relations is that of putting this incentive to work...a task in which personnel administrators must share a difficult and critical part of the burden." Thus Lawrence A. Appley, vice-president in charge of the personnel division, American Management Association, in the foreword to the program of the recent Industrial Relations Conference of the Association. Excerpts from some of the addresses given at the conference follow:

Management's Job

Management must take the initiative in promoting good will between employers and employees, according to Sam A. Lewisohn, president, Miami Copper Company.

In some management circles, Lewisohn said, it is the fashion to evade this responsibility by listing the problems with which management is confronted, and, too often, management attempts to meet difficult manpower situations by "becoming a grievance committee," by listing the obstacles which it feels have been placed in its path. It is particularly disturbing that such a state of mind should exist at this time, because with the financial conditions induced by the war, the adjustment of wages will require in the coming years the greatest patience and the greatest tact.

"Relations with unions have become a more important factor than ever," Lewisohn stated. "Working out cooperative and constructive relations with unions...is part of the daily task of management. The very future of the country depends upon the courage and fairness with which management approaches these problems."

What are the principles that underlie a healthy functioning of the industrial body? First, according to Lewisohn, management must give as much attention to the industrial relations problem as it does to other matters involved in successful operations. It must attack it as a major and not a minor problem. It must study and install the very best practices of personnel management.

"But," he continued, "having set up a personnel department, management cannot assume that its problems are solved...the initiative and responsibility rest with management and it cannot over-delegate these (human) relations. Personnel department should be regarded merely as a sort of limb of the management . . . The manager must constantly make clear that he is in contact and maintains an intimate relation with his employees. He must give each employee a feeling that he belongs to an organic entity."

"Americans have a head start in approaching human relations, because we have a natural spirit of good nature between men in different groups," Lewisohn concluded. "We should take advantage of this head start to inject this good nature and good spirit into our working relations between management and men. Management should carefully preserve it...it should use it as the foundation upon which to build a sound structure of human relations."

What's Ahead

Manpower is not "over the hump" as some people seem to think, said Lawrence A. Appley, deputy chairman and executive director, War Manpower Commission. " 'Manpower' is a wartime term for 'personnel', and 'personnel' is a peacetime term for 'people'," he stated. " 'Over the hump' I presume means 'past the problem stage.' There has never been a period in history when there have not existed serious problems in connection with personnel."

During the last two years the greatest volume of complaints from employers and workers has been directed toward uncertainties, confusion, and lack of definite planning. Employers have had no long-range and definite production schedules, and they have operated on short-time stocks of raw materials. Workers have been confused as to where they were needed. Those who have made such complaints have little conception of the nature of war, Appley believes. Uncertainty and confusion are inherent in wartime planning. The next six months contain greater uncertainties

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"TISSUE-THIN" SPINDLE OILS *that carry tons*

Clearances in spindle bearings, low in the fourth decimal place, have created a real lubrication problem. No untreated oil will solve it permanently.

But give a good oil that extra film strength that enables less oil to do more work and stand up under high speeds—and you will have efficient lubrication. Wear will be less; temperatures will go down; speeds up. Kensington Spindle Oils have that quality. Their merits, listed below, enable them to meet more needs with less grades, and to provide maximum efficiency for all types of grinders, drills and tools.

For the full story and data on maintenance of spindle bearings, write for the new KSO booklet. E. F. HOUGHTON & CO., 303 W. Lehigh Ave., Philadelphia 33, Pa.

Merits of *Fortified* KENSINGTON SPINDLE OILS

High Film Strength—twice that of similar oils untreated. Spindle wear is reduced because the oil is fortified to carry heavier loads in close clearances.

High Viscosity Index—a natural property of the petroleum stock used, and not artificially attained.

Stability—Oxidation-resistant. . . . No harmful acids developed which would corrode or etch bearings. No sticking of spindles. Minimum tendency to sludge.

High Degree of Oiliness—Chemical treatment provides lubricity as well as film strength. Power consumption reduced, due to lower friction.

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SOONER OR LATER, THEY ALL FALL!

Unless your oily floors are protected with *SPEEDI-DRI*

To the man responsible for your production and to the man whose job it is to keep insurance costs down, slipping and falling accidents present a serious problem — but one that is, fortunately, easily solved by SPEEDI-DRI — a white, granular substance that provides an immediate, non-skid surface on the oiliest, greasiest floor. SPEEDI-DRI soaks up oil and grease like a blotter absorbs ink, drawing *all* the oil (even old stains) right out of wood, steel, or concrete. At the same time, it retards fire because it won't burn even when oil-soaked; brightens up the plant; saves vital manpower needed for more productive jobs than cleaning; speeds production by making workers sure-footed. Write for literature and FREE SAMPLE.

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OIL AND GREASE ABSORBENT

than any previous period during the last two years. "There can be no more definiteness and no more certainty in plans for the future until the course of events in Europe becomes more clear."

"As far as can now be determined," he said, "war production will continue until July 1 at approximately the same level it attained during the last quarter of 1943. This is in terms of total production. . .

"In comparing civilian manpower figures, it is necessary to compare July with July because of seasonal peaks. For example, while the total labor force in July, 1943, was 64.8 million, in January, 1944, it was 60.7 million. The difference is due mostly to a seasonal drop in agricultural workers. By July, 1944, as compared with July, 1943, there will be approximately 100,000 more workers required in the civilian labor force. This increase is to be found in transportation, fuel, utilities, etc. The armed forces require an increase in net strength of 800,000 on July 1, 1944, as compared with January 1, 1944. Since most of these come from the labor force, it is, therefore, estimated that an additional 900,000 people have to be added to the total labor force. All this adds up to the fact that we have reached a plateau in the production and manpower situation. It is necessary to point out that we have not yet started down. . .

"However, while there may be no decrease in total war production, there will be decreases in certain communities. . . . Some tight labor market areas will become tighter. Others will become surplus areas. Some surplus areas will become tight areas.

"In view of this condition the manpower program must be extremely flexible. This can be attained only through administration and programming in local areas.

"There must be far greater emphasis upon utilization and training programs and activities. . . (they) have been gaining in impetus, there has been increasing talk about them and attention given them during the past seven or eight months. This effort cannot be slackened for one moment. We must get greater productiveness out of the people on the job. Turnover and absenteeism must be further reduced. We can no longer compromise with, or sidestep, this responsibility.

"During the last half of 1943 the manpower program in this country took on a very definite pattern which gives us a workable sequence of actions to take in meeting any manpower situations. They are here outlined briefly:

"1. Accurate determination of the total manpower situation by areas.

"2. Accurate determination of the

The convoy leaves at midnite

In busy sea-ports all over the world Industrial Brownhoist cranes are speeding loading operations, saving thousands of man-hours in the handling of vital war materials. And in steel mills, coal yards, railroads, chemical plants and other war plants throughout the country I. B. cranes are also working night and day—seldom, if ever, requiring time out for repairs. They get more work out of a gallon of gas or fuel oil than you'd think possible. They increase the operator's efficiency because their monitor-type cabs provide 360° visibility, better ventilation and less noise. Write us for complete facts about these sturdy, time-saving, money-saving cranes. Industrial Brownhoist Corp., Bay City, Michigan. District offices: New York, Philadelphia, Pittsburgh, Cleveland and Chicago.

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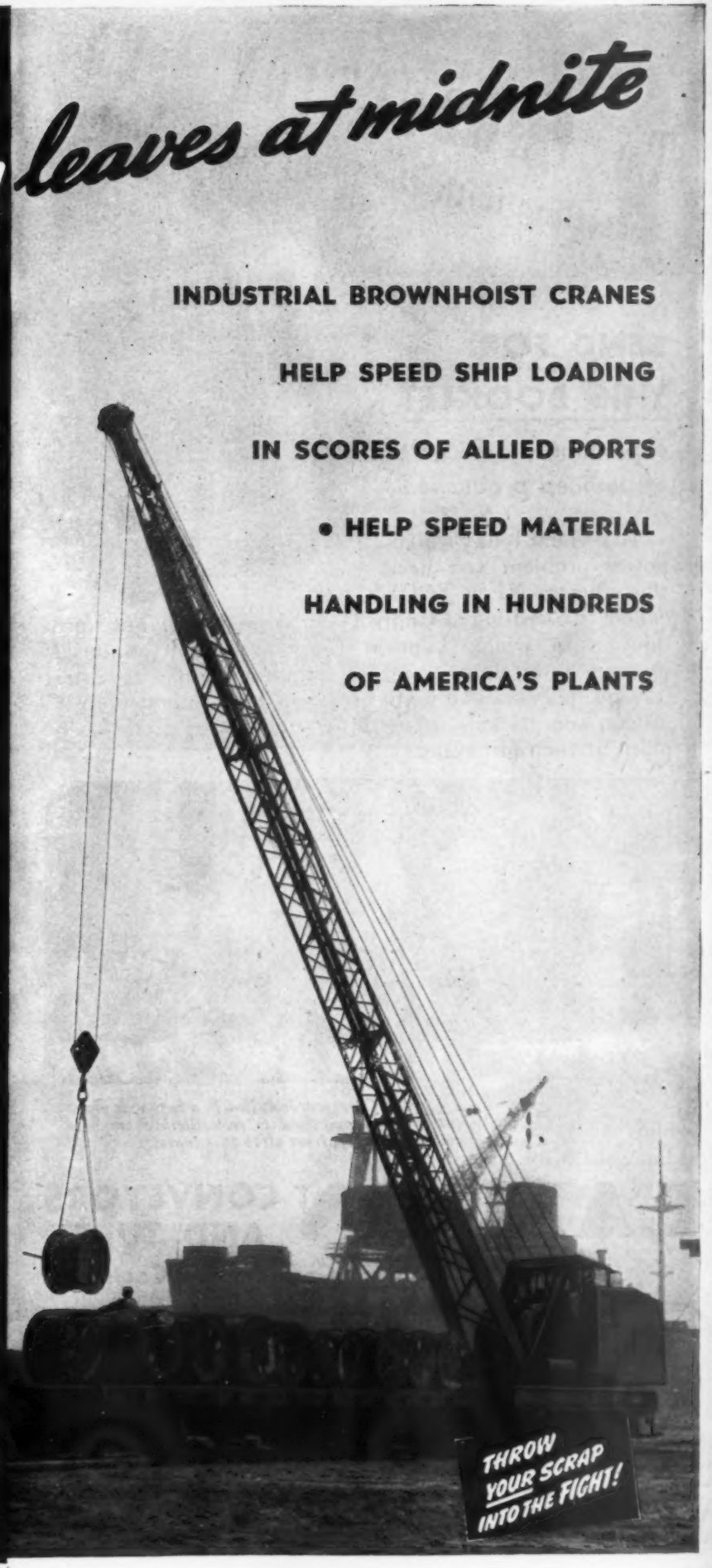
INDUSTRIAL BROWNHOIST CRANES HELP SPEED SHIP LOADING IN SCORES OF ALLIED PORTS • HELP SPEED MATERIAL HANDLING IN HUNDREDS OF AMERICA'S PLANTS



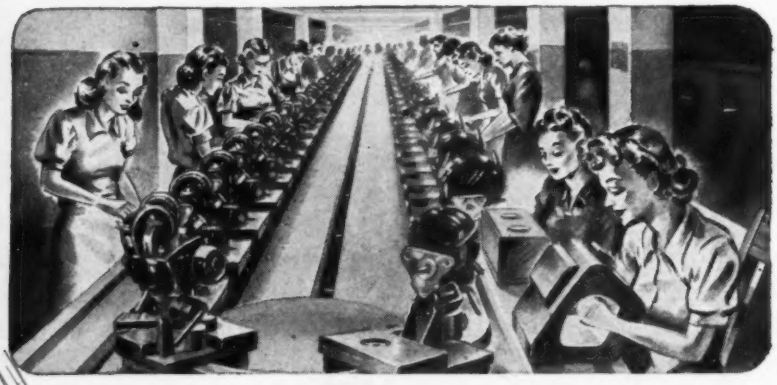
To PRODUCTION MEN

wrestling with the manpower problem . . .

SEND FOR THIS BOOKLET

explaining a new system of planned production

To combat today's manpower problem you need this efficient NEW TOOL called "Co-ordinated Control"—a system of planned production in which Lamson Conveyors keep materials moving with a minimum of handling, while an interlocking network of Lamson Dispatch Tubes delivers orders, time tickets, blueprints, small tools, at the right point at the right time.



Lamson Conveyors installed in a busy war plant cut the time required to manufacture magneto coils for aircraft from 40 to 15 minutes.

LAMSON CONVEYORS AND TUBES

Tools for Co-ordinated Control

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relatively urgency for products and services.

"3. Accurate determination of individual employer needs for manpower.

"4. Determination and removal of the causes for failure to meet and maintain employment levels.

"5. Guidance of workers to places of employment where they are most needed.

"6. Balancing manpower supply and production schedules.

"7. Administration of these steps at the local level.

"If the deductions presented here are reasonably sound, if the predictions as to the next six months are at all reliable, if the program outlined has any merit, then there are very definite actions to be taken by employers and personnel executives:

"1. Keep currently advised of the classification of your labor market area. A new classification is made at the first of each month, and your community's classification may change at any time.

"2. See that you have a production urgency rating if you are entitled to one. These ratings are secured from the Area Production Urgency Committee which is chairmanned by the War Production Board, or from the Regional Director of the WPB.

"3. Give the utmost care and attention to the 270 report which you submit to the USES of WPB. Any inaccuracy will be reflected in the economic life of your community.

"4. Find out if the procedure of establishing employment ceilings and/or manpower priorities is in effect in your community. If so, be sure you have such a ceiling and/or priority.

"5. Have a specific and carefully worked out manpower program for your plant or company.

"6. Ascertain what placement controls are in effect in your particular area.

"7. Remember that if you cannot get out production because of inability to meet and maintain employment levels, and you are in a critical labor market area, it will be necessary to adjust your production schedule to bring it into balance with manpower.

"8. Do everything in your power to strengthen the work of the local War Manpower Commission Management-Labor Committee.

"9. Continually review your replacement schedules for Selective Service and make them more realistic.

"10. If you have not already, the time has come for you to develop a realistic program in relation to the re-employment of veterans."

(Continued on page 246)

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"NEW LAMPS FOR OLD..."

...is the heart of any ...stem. In the Power Buffalo Forced and Draft Fans mean the ...is always up to par.

When Edison changed for all time the complexion of Night, an Industry was born. Lamps to light the night of the studious, the gay, the industrious, and just the plain folks of the World, began to flow from America's factories in an ever-increasing stream . . . always better lamps . . . at ever lower prices.

When those pioneer electric lamp makers began to build factories they found Buffalo Fans the answer to their ventilating problems. Keeping pace with their swift improvement in manufacturing processes, Buffalo Fans and Air Washers kept air clean and fresh heated or cooled as the season required.

Today, under the terrific stimulation of the War, the lamp industry has become many-faceted. Today Buffalo Fans, Air Washers and Comfort Conditioning Cabinets are serving every branch of the huge lamp industry . . . helping turn out new lamps for old. Our sixty-six years of experience in handling air at any temperature and humidity and any pressure have given Buffalo engineers the right to say . . . "When there's an AIR problem . . . let "Buffalo" supply the answer."

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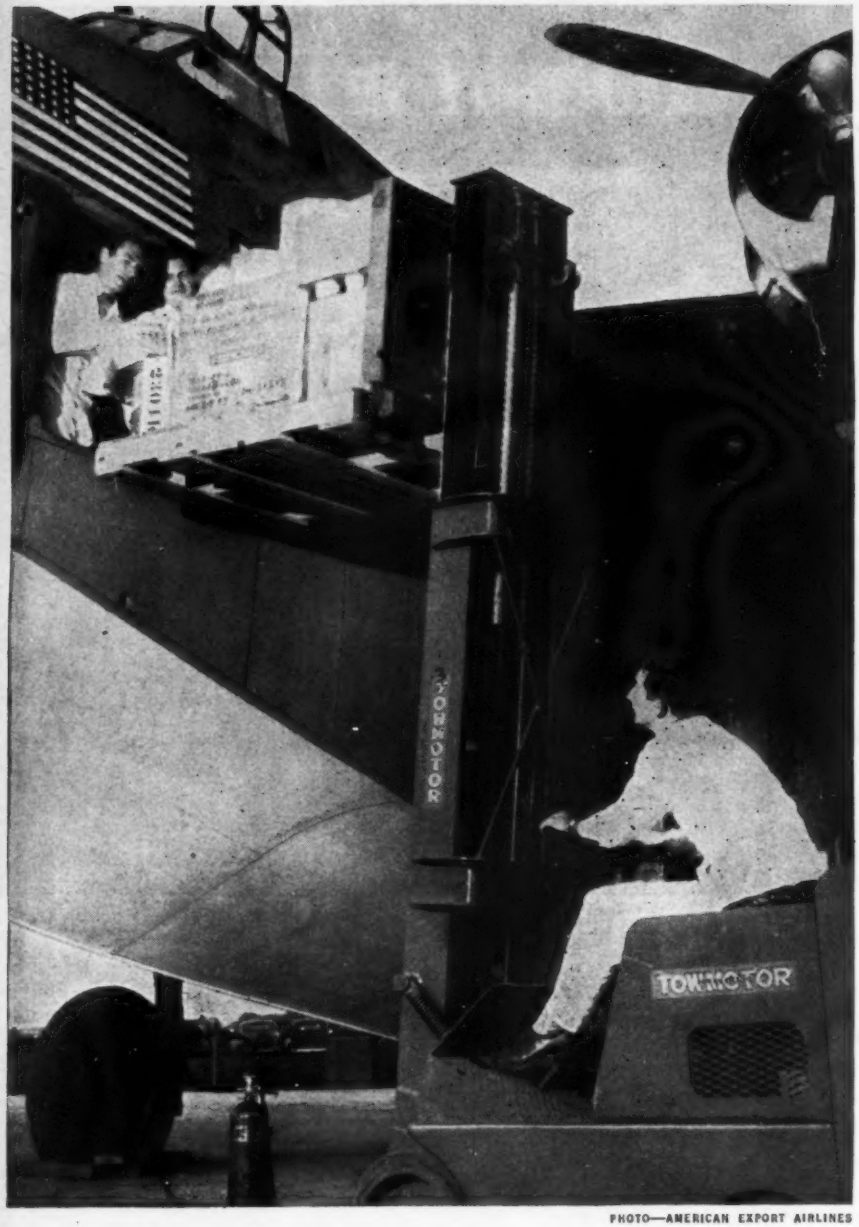

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THE 24-HOUR ONE-MAN-GANG

TOWMOTOR CORPORATION • 1238 E. 152ND STREET, CLEVELAND 10, OHIO

STRAIGHT-GAS POWERED INDUSTRIAL TRUCKS EXCLUSIVELY—SINCE 1919

(*Continued from page 244*)

Labor and Post-War

"The average war worker today is producing two and one-third times as much per hour as the average worker in 1917-18," said Robert J. Watt, international representative, American Federation of Labor. "Ninety-nine percent of our war work has gone forward without interruption from labor disputes, even though many millions of new, inexperienced workers are included in the army of war workers represented by our labor unions.

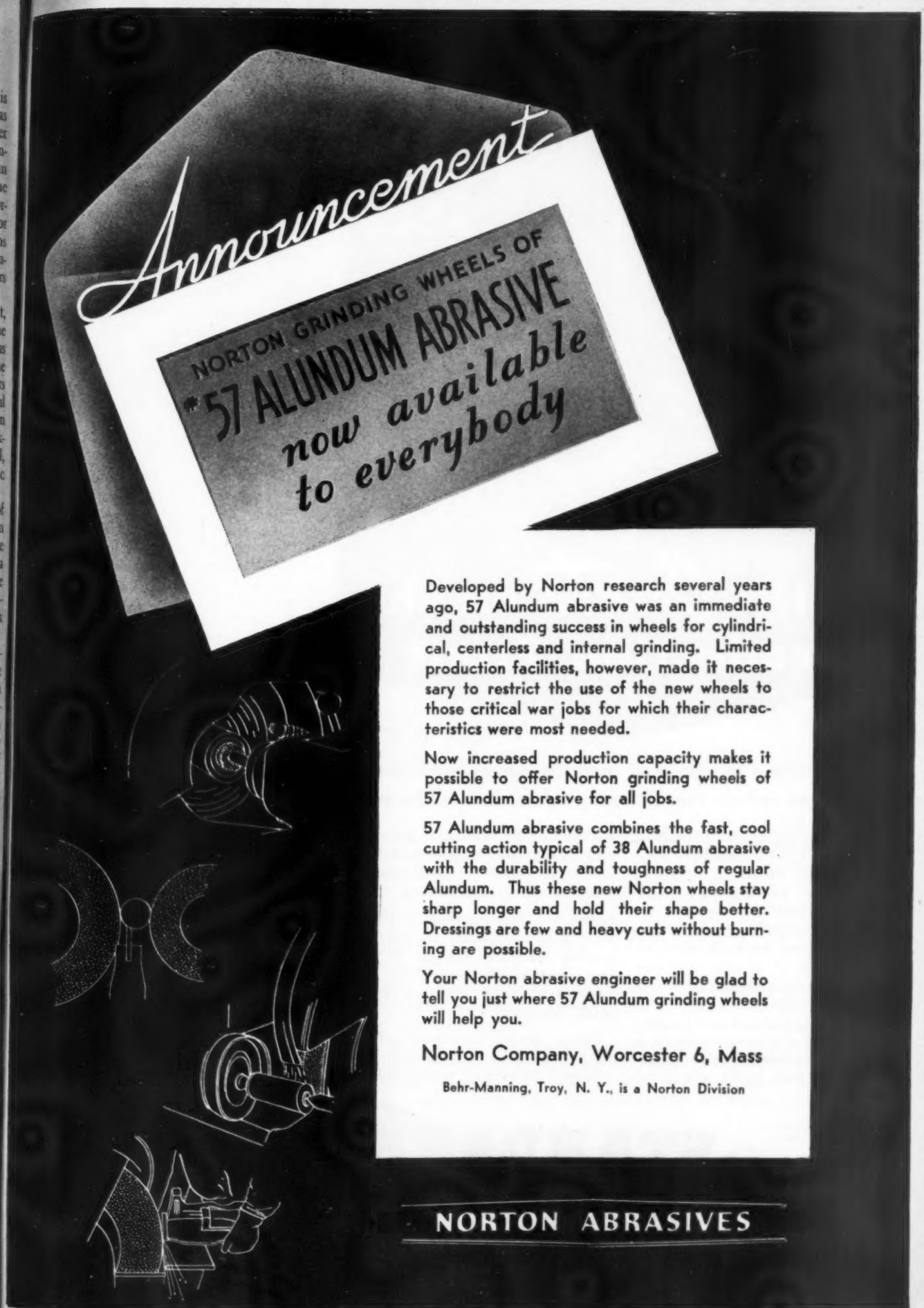
"In terms of accomplishment, effort, and risk, and in terms of winning the victory, the American worker has earned our respect. Without the American army of production soldiers there could have been no successful assault in the South Pacific, no invasion of Africa or Italy. If American workers had not labored hard and well, there might not have been the heroic story of Stalingrad.

"Despite all this, there are a lot of people, including the top pushbutton pushers in Washington, who think the way to beat Hitler is to put labor in a straitjacket. They want power in the hands of the ideology folks in Washington, who represent the weakest link on our domestic front.

"There has been a lot of labor-baiting, class against class agitation, in the country recently. It has ranged from the anonymous New Year's Eve statement down to the group who proclaim themselves through the headlines they control. Some enjoy the immunity of the Congressional Forum. Most of them undoubtedly believe they are virtuous. But whether they are the sanctimonious self-appointed defenders of the right, or the folks of the left who eagerly respond to self-induced persecution, they are extremists who feed the fuel of the flames of class hatred.

"The question which occurs to me, and it affects the outlook for post-war labor stability, is a simple one. What is the purpose of smearing the millions of American workers whose day to day work has achieved production records which have made our victories possible? They may not recognize it, but those who array class against class may be planting a time bomb against our democratic institutions. They are creating dissension and disunity which may undermine respect for the elected representatives for our democracy...

"I think the outlook for post-war labor stability will depend in large measure on whether the leaders of government and industry, the agencies of public opinion, and the patriots of platform and banquet tables are going



Developed by Norton research several years ago, 57 Alundum abrasive was an immediate and outstanding success in wheels for cylindrical, centerless and internal grinding. Limited production facilities, however, made it necessary to restrict the use of the new wheels to those critical war jobs for which their characteristics were most needed.

Now increased production capacity makes it possible to offer Norton grinding wheels of 57 Alundum abrasive for all jobs.

57 Alundum abrasive combines the fast, cool cutting action typical of 38 Alundum abrasive with the durability and toughness of regular Alundum. Thus these new Norton wheels stay sharp longer and hold their shape better. Dressings are few and heavy cuts without burning are possible.

Your Norton abrasive engineer will be glad to tell you just where 57 Alundum grinding wheels will help you.

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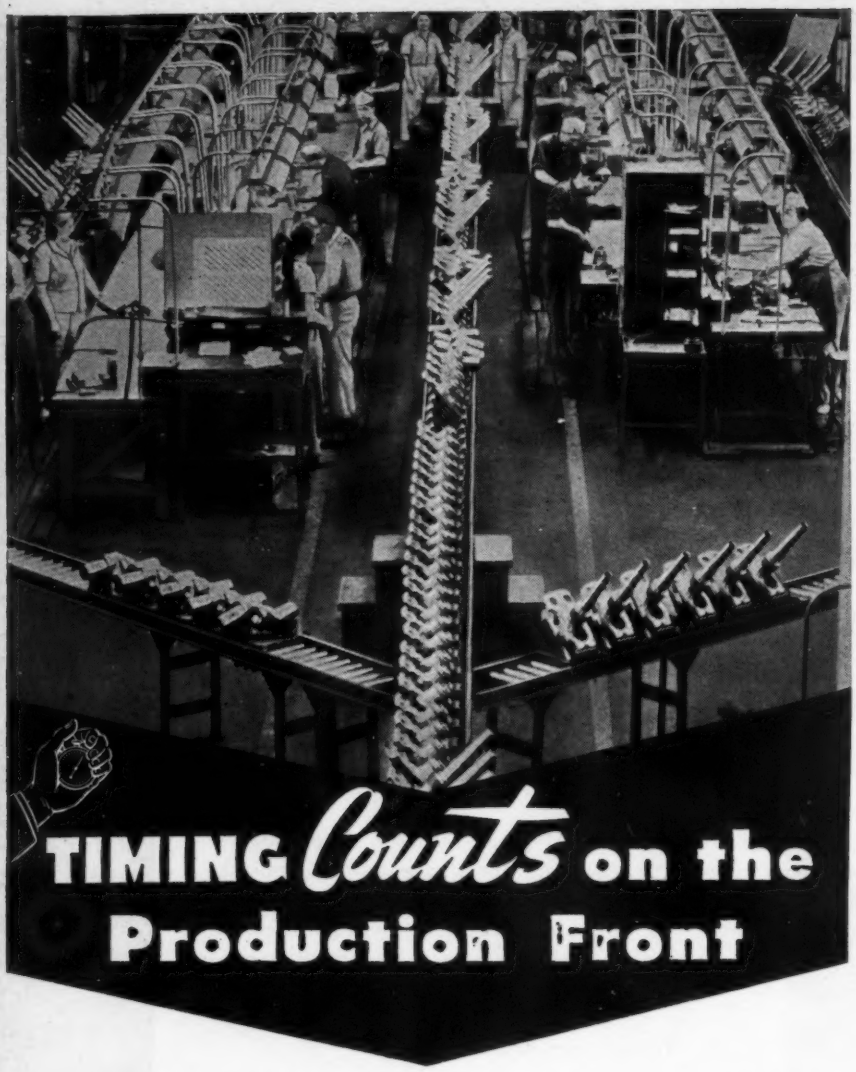
NORTON ABRASIVES



TIMING *Counts* on the Production Front

. . . controlling the flow of material saves man-hours and makes certain that delivery schedules will be met

On the playing fields of sport—and on the field of battle — success depends on *timing*, rhythm of motion. Timing is a vital element in production, too.

Having the right material at the right place at the right time — just enough of it and not too much — is a characteristic of efficient production.

Keeping production synchronized — timed — involves planning all along the line, to relieve congestion at one point, speed up movement at another, to the end that goods will be produced with precision and speed, and at an economical cost.

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★ ENGINEERED FOR FASTER PRODUCTION ★

to continue to stir up dissension and promote the class struggles.

"What would be the reaction of this gathering if I came here and talked about a steel company which falsified records and sent defective plates to the shipyards, a copper wire company which rigged false inspections to cover defective wire on which the lives of our boys depend, or an airplane company which shipped bum engines?

"I say here and now that it would be as unwise and unpatriotic for labor people to denounce big business or big brass hats for the sins of the few as it is now for troublemakers to be provoking disunity by smearing American workers and their labor unions for the sins of their few black sheep. . .

"The prospects for stability in the post-war world depend upon our learning how to live together in a constitutional representative democracy. And we can live together only if we acquire mutual respect, only if we apply the same rules of the game to whichever side is at bat, only if we judge the group by the action of the majority and judge the individual only by the actions of that individual. . .

"Whether we succeed in establishing post-war labor stability will depend in large measure on our capacity to create an economic system in which jobs will be the accepted right of all who are willing to work. . .

"Will the workers get jobs without being dependent on a bigger and better WPA? Who will determine the allocation of machine tools and raw materials? Will the big corporations which have the biggest cash reserves be able to freeze out the little fellow?

"Will the wartime wedding of convenience between the New Deal and financial 'big shots,' which may have been necessary to secure efficiency in war production, end in an abrupt divorce which may find the 'big shots' occupying a position not in the best interests of the nation?

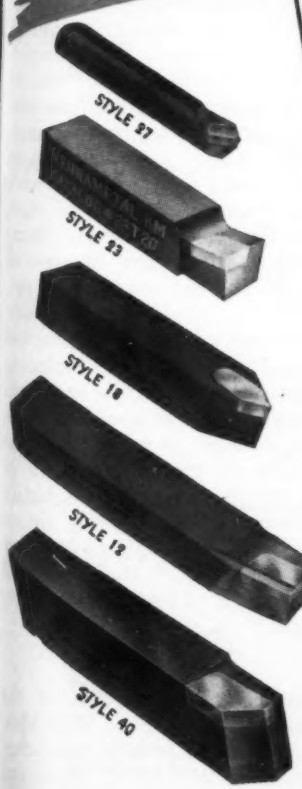
"I don't know the answer to these questions. If I did, I could discuss the outlook for post-war labor stability with more intelligence. But I do know that if management and labor don't start talking and planning now, we are likely to have a dizzy joy ride with an awful hangover which won't clear up on Sunday morning."

Rehabilitating Veterans

The purpose of the Veterans Administration Vocational Rehabilitation Service, as outlined by C. F. Hostetler, Vocational Rehabilitation Officer, is to "restore employability lost by virtue of a handicap due to a service-incurred disability."

The 78th Congress of the United

THE RIGHT STEEL-CUTTING TOOL *for every Job*



To get maximum steel-cutting production—consult KENNAMETAL field engineers about the proper application of KENNAMETAL, the wear-defying tool material whose chief ingredient is a unique, super-hard intermetallic compound (tungsten-titanium carbide). KENNAMETAL engineers will help you . . . (1) select the right grade . . . (2) choose the correct tool style . . . (3) determine the most efficient machine set-up . . . (4) install a money-saving tool maintenance program.

Yes, KENNAMETAL engineering service assures the *right* KENNAMETAL tool on every job . . . and performance studies show that the *right* KENNAMETAL tool, used properly, often can remove stock from the toughest steel up to 3½ times more efficiently than other carbides! There's a KENNAMETAL field engineer in your locality. Ask him for advice—and always keep a copy of our Tool Manual on hand. Write for one today.

KENNAMETAL

KENNAMETAL *Inc.*

130 LLOYD AVE., LATROBE, PA.

SUPERIOR CEMENTED CARBIDES

REGIMENTATION OR LIBERATION

Which?

Business and Industry must make the choice.

If we want soft security we must accept Government regimentation and make the most of it.

If we want liberty of action, and I think we do, we must stand ready to "take care of ourselves".

Many industries today are living up to the limit of their incomes. They've stepped up their office and plant "standards of living" to match artificial and temporary levels of volume, and have little left for emergencies.

We in the executive group, have by no means been free of the "take care of us" philosophy. We cry to be free of governmental regimentation and control—but when something threatens where do we go for help? To Uncle Sam!

We've criticized individuals who want to be "taken care of", who want security of food, clothing and shelter.

A business is a corporate citizen of this country. As a citizen it can no more have freedom *and* protection than can the individual. If a business wants to be "taken care of", then it must take the consequences.

Who knows when Business and Industry will be "laid off without notice". In some places it's happening today. Are *you* ready? Conversion soundly planned? Postwar product well in hand?

Geo. D. Trundle Jr.
President

1919-1944

THE TRUNDLE ENGINEERING COMPANY

Brings to Industry and Business

***25 Years* OF MANAGEMENT ENGINEERING EXPERIENCE**

GENERAL OFFICES • CLEVELAND • BULKLEY BUILDING

CHICAGO
City National Bank Bldg., 208 S. La Salle St.

NEW YORK
Graybar Bldg., 420 Lexington Ave.

States passed Public Law No. 16, which provides for a program to last for six years after the termination of the war, during which period a veteran with a 10 percent or more disability may receive training up to four years, specifically aimed at the restoration of employability.

To be eligible for the training, the man must have been in active service after December 6, 1941, and during the present war; must have been honorably discharged; must have a disability incurred in or aggravated by such service, for which pension is payable under laws administered by the Veterans Administration; and must be in need of vocational rehabilitation to overcome the handicap caused by such service-incurred disability.

The program includes advisement, training, and placement. Previous to entrance, the veteran will undergo a process of advisement in which his abilities and disabilities will be considered as a basis for his adjustment.

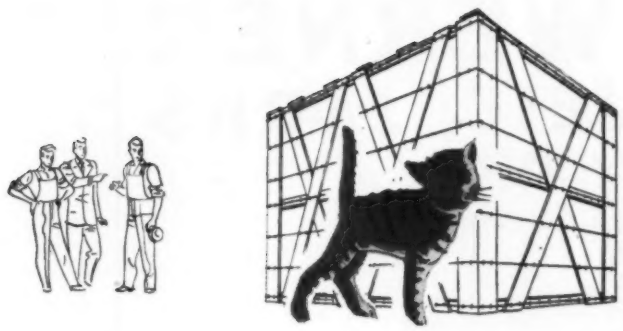
In the past, the road of the handicapped person has been hard, Hostetler stated. The average employer has failed to face the problem squarely. He has had a vague feeling that it was not good business to hire a man with a disability, that somehow every job required two hands, two feet, two eyes, and an able body.

This attitude is now outmoded. Industry has put itself on record with respect to the efficiency of the handicapped. The disabled, properly placed, not only equal the normal in their work quotas, but act as morale builders to other workers.

"The Veterans Administration is daily receiving evidence that thoughtful preparation for the employment of the handicapped is going on," he continued. "Certain industries are making extensive plans. Job qualifications that have relation to the specific work are being scrapped as signs of managerial inefficiency. Jobs are being analyzed from the point of view of the physical abilities required to perform them. . . . Some day a new science of work will solve the problem of suiting jobs to people, including the handicapped, but, while industrial engineering is experimenting with new work concepts, it is probable that the problem of the handicapped of this war can be handled by selective placement following relatively simple surveys of plant operations as they now exist to see where the abilities of the handicapped of various types may be utilized."

* * *

Summarizing the program of the Employment Service of the War Manpower Commission to help war veterans, Brig. Gen. William C. Rose said



"What do they mean— there's more than one way to skin a cat?"

Don't worry, Kitty, they're not talking about you. They're talking about ways to improve and to reduce the cost of their postwar products. And they know that the use of engineered shipping containers is one way of doing it.

"Just boxes" are a thing of the past. Shipping containers are no longer "just boxes." Today, they perform many *extra* services.

Properly designed and made, containers become part of the product. Frequently, they save time and money on the production line. Often, they reduce the delivered cost of the product. Many times, they simplify both packing and unpacking.

Perhaps General Box containers can serve you, too. It's easy to find out. Just write for complete information today.

The Container on the Production Line: This is but one of the many ways in which a General Wirebound crate speeds production, saves assembly time and reduces cost. The bottom of the crate, on which the base of the product is placed, is used as a skid on roller conveyors. At the end of the production line, a "mat" (the common name for the one-piece upright section which is folded to make the four sides) is placed around the product and the base of the crate. The top of crate is simply and easily put in place and the finished product is ready for shipment.

Today, military and vital civilian container problems are adding to General Box Company's "know how" which may also be helpful to you tomorrow.

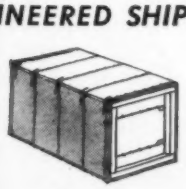
GENERAL BOX COMPANY

GENERAL OFFICES: 504 North Dearborn St., Chicago, Ill.

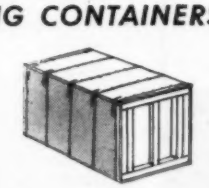
DISTRICT OFFICES AND PLANTS: Brooklyn, Cincinnati, Detroit, East St. Louis, Kansas City, Louisville, Milwaukee, New Orleans, Sheboygan, Winchendon.

Continental Box Company, Inc.: Houston, Dallas.

ENGINEERED SHIPPING CONTAINERS:

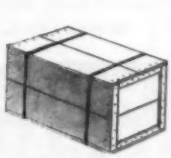


General All-Bound Box

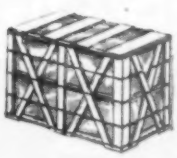


General Rock Fastener Box

General Cleated Fibreboard Container



General Nailed Box



General Wirebound Crate

Factories doing war work can move machinery, lift heavy loads, bend rods, press bushings, etc., quicker and easier with

HEIN-WERNER
HYDRAULIC JACKS

(Model 20.10A)

HERE'S WHY H-W HYDRAULIC JACKS *are easier to operate*

In a split-second, mere finger pressure is transformed into a lifting force of several tons

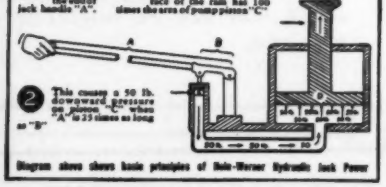


Diagram above shows basic principles of Hein-Werner Hydraulic Jack Power

Hein-Werner Hydraulic Jacks are *great* for many industrial jobs . . . Applications are almost unlimited.

All H-W models are compact, sturdy and are factory tested at 1½ times rated capacity. They are *super-powerful* and *easy-operating.*

Complete line includes models of 3, 5, 8, 12, 20, and 30 tons capacity. For details, ask your industrial supply distributor, or write us.

HEIN-WERNER MOTOR PARTS CORP.
Waukesha, Wisconsin

HEIN-WERNER HYDRAULIC JACKS
Are Built Right and Priced Right

"We have completed a 'conversion' program on Army jobs and another on Navy jobs. We know what military jobs best fit into what civilian jobs. We have developed highly skilled professional techniques for the placing of the handicapped. We have set up a series of local demonstration offices to perfect the administration of veterans' placement. At the points of demobilization, in hospitals and convalescent centers, job counseling is being done. We expect additional communities, ready and willing to help the veteran, will be working with us on the basis of these first demonstration programs."

•

Housing Department Helps Employees

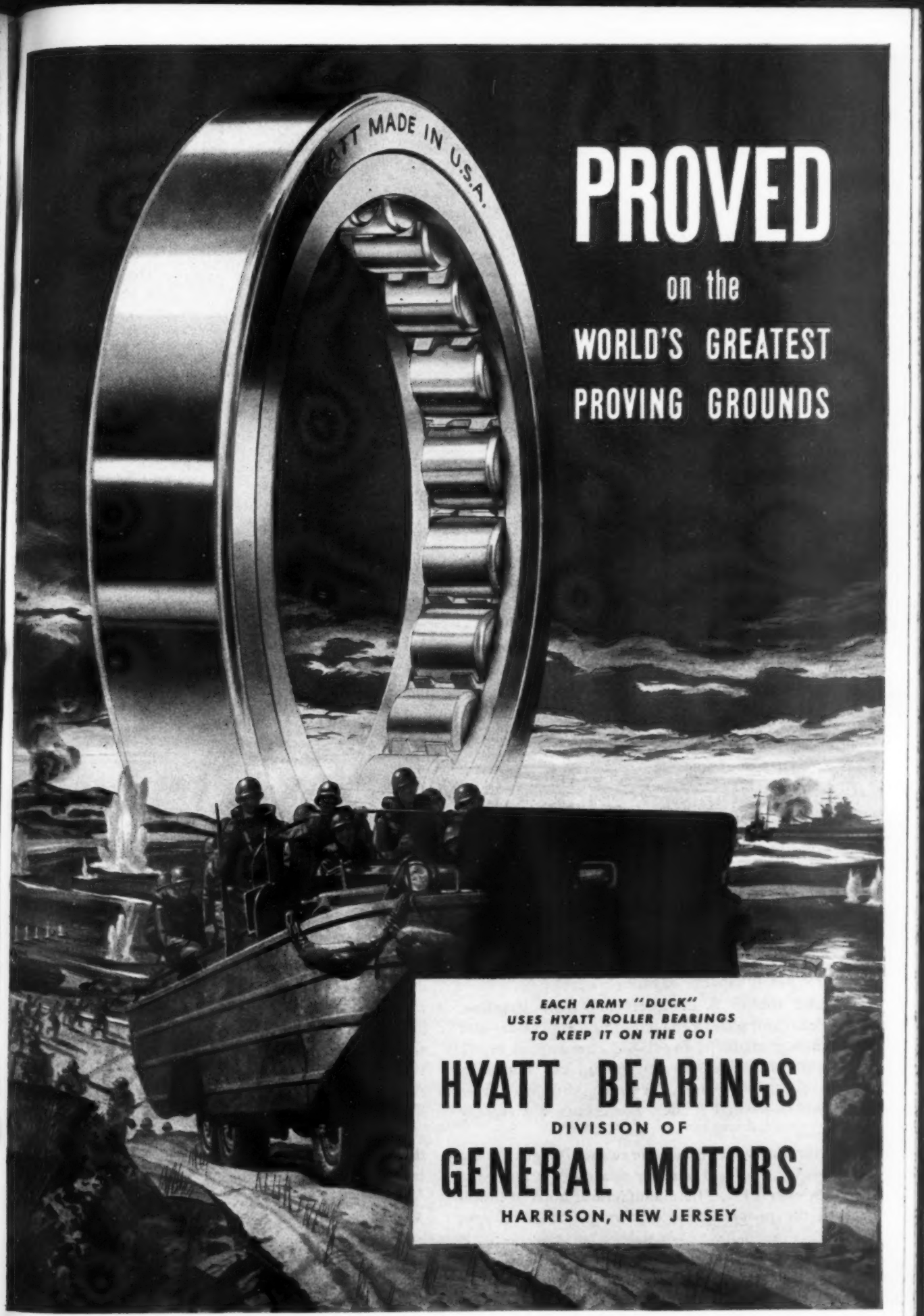
"For housing shortage the Greeks may have had a word, but it would contain just as many headaches," says Charles Qualls, head of the home procurement department, Interstate Aircraft & Engineering Corporation, Los Angeles. "Lack of workers' living quarters has a direct influence on absenteeism, labor turnover, migration of labor, and the commoner forms of illness based on the desire to escape frustration and bewilderment."

The rental shortage was foreseen by this company when huge throngs of job seekers began coming into the area, so it set up a separate department, functioning under the personnel manager, to help new, old, and prospective employees to find homes.

Every possible method of relieving the housing shortage was tried. A bulletin was sent to workers, asking them to notify the housing department whenever they heard about a rental possibility. Rental forms were distributed at strategic points throughout the factory. Classified ads were put in the local newspapers. Letters were sent and telephone and personal calls were made on home and apartment owners and likely real estate firms. Various government agencies were solicited, as well as the YWCA and YMCA, and other local agencies.

Action was taken as soon as requests came in. Telephone calls were made, letters written where necessary, and applicants for federal housing projects were helped to qualify by the writing of letters and ironing out the difficulties incident to government regulations. A close check was kept on the outcome of each request.

Interstate feels that it has aided the war effort materially by the operation of its housing department, which has helped to reduce absenteeism and labor turnover.


ATT MADE IN U.S.A.
PROVED
on the
WORLD'S GREATEST
PROVING GROUNDS
EACH ARMY "DUCK"
USES HYATT ROLLER BEARINGS
TO KEEP IT ON THE GO!
HYATT BEARINGS
DIVISION OF
GENERAL MOTORS
HARRISON, NEW JERSEY

This is Synthetic Rubber

Synthetic rubber is a new basic raw material which is processed, treated and formed in much the same way as natural rubber. And...like natural rubber...it is of different types, is capable of many variations.

Synthetic rubber is manufactured from gasoline, alcohol, coal and gases kept liquid under pressure and is now being made in five basic commercial types. Each type has distinct properties and characteristics that fit it for specific tasks. For some, synthetic rubber is superior to natural rubber. For others it is equally as good.

To determine which synthetic rubber is right for the job, however, requires a really thorough knowledge of rubber chemistry. The manufacturer must be familiar with the properties of all five commercial types . . . Buna-S, Buna-N, Neoprene, Thiokol and Butyl.

United States Rubber Company uses all five basic types of synthetic rubber and is thoroughly familiar with the characteristics, properties and suitability of each type to the task for which it is intended. As the nation's largest user of synthetic rubber, "U.S." has built up a tremendous backlog of knowledge of this new basic raw material and experience in processing synthetic rubber to handle a certain definite job. Today, this knowledge and experience are being drawn upon to the fullest in supplying the Armed Forces and war industries with the synthetic rubber and synthetic rubber products they need.

A copy of "The Five Commercial Types of Synthetic Rubber" will be a valuable addition to your files.

Listen to the Philharmonic Symphony program over the CBS network Sunday afternoon, 3:00 to 4:30 E. W. T. Carl Van Doren and a guest star present an interlude of historical significance.

1230 Sixth Ave., Rockefeller Center, New York 20

UNITED STATES RUBBER COMPANY

Ice Cubes of Yesterday

TURN back the clock to yesterday. Across the years comes the ring of biting saws. The crickety squeak of sled-runners and bundled feet, on crispy snow. The laughter and banter of toiling men. The blowing of frosted breath. Grunting! Clanking! — *It's ice-cutting time!*

In those days, it wasn't easy to keep next summer's food from spoiling.

HOW TIMES HAVE CHANGED!

Look at that gleaming white refrigerator of yours. Contemplate its contributions. More than just a 24-hour-a-day servant; more than just a stimulus to the family appetite; more than just a beautiful piece of furniture—it is literally a guardian of human lives — *your family protector!*

Other inventions have been more spectacular, more talked-about; but none has added so much to the happiness and comfort of so many people.

A grateful nation pauses to give thanks to American inventive, engineering and manufacturing genius for the blessings and conveniences of *the mechanical refrigerator!*

HOUDAILLE* is proud to have contributed to the dependability and excellence of modern refrigeration—proud to have worked hand-in-hand with the producers of mechanical refrigeration and other kindred household appliance industries.

We will continue, increasingly, in the postwar period, to cooperate and counsel with these important industries, in their efforts to put still further comforts and conveniences into your home.

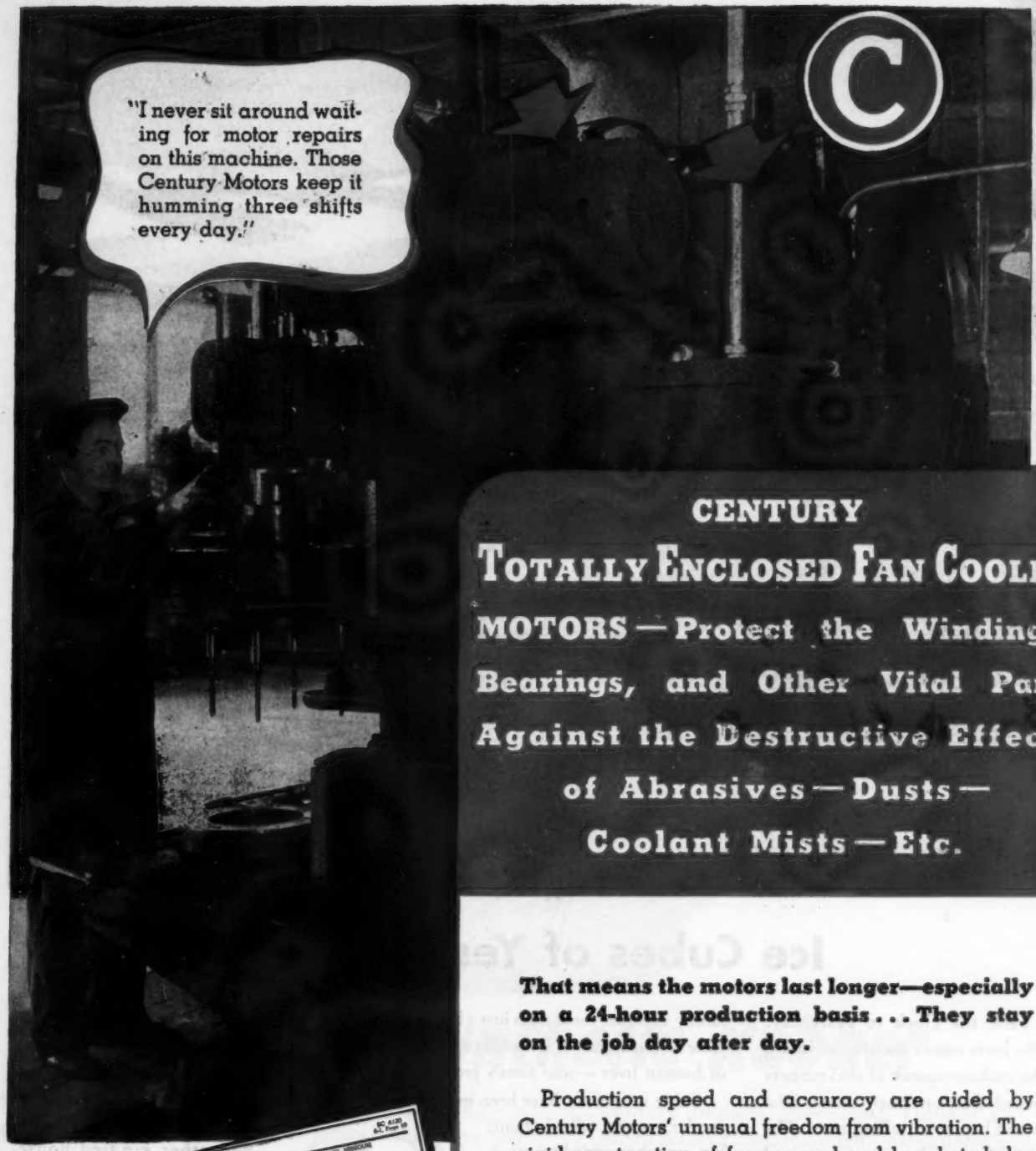
HOUDAILLE-HERSHEY CORPORATION

Executive Offices — Detroit

Manufacturers of precision parts and equipment for the automotive, aircraft, railway, maritime, mechanical refrigeration, radio, and other industries

© 1944, HOUDAILLE-HERSHEY CORPORATION

*Pronounced: "HOO-DYE"


"I never sit around waiting for motor repairs on this machine. Those Century Motors keep it humming three shifts every day."

CENTURY
TOTALLY ENCLOSED FAN COOLED MOTORS — Protect the Windings, Bearings, and Other Vital Parts Against the Destructive Effects of Abrasives — Dusts — Coolant Mists — Etc.

That means the motors last longer—especially on a 24-hour production basis . . . They stay on the job day after day.

Production speed and accuracy are aided by Century Motors' unusual freedom from vibration. The rigid construction of frames and end brackets helps maintain these original uniform characteristics throughout the long motor life. In addition, Century totally enclosed fan cooled motors are liberally ventilated to keep the windings and bearings cool.

Ask for Century TEFC (Totally Enclosed Fan Cooled) Motors for atmospheres charged with abnormal quantities of destructive material, that give you extra hours of production, fewer shutdowns with less expense for care and upkeep—at only a little extra cost over Century general purpose, open rated motors.

Write for your copy describing Century TEFC Motors.

Century MOTORS

CENTURY ELECTRIC COMPANY 1806 Pine Street, St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

337

THE SCENE: Lighting Conference

THE VOTE: MILLER Fluorescent—Unanimous

Lighting meetings like this have happened many times in the past in many a busy war plant—will happen many more times during crucial 1944. Inevitably the vote goes, hands down, to MILLER 50 & 100 FOOT CANDLERS, and here's why . . .

PLANT MANAGER—"We still have stiff production quotas to meet—with greener help. MILLER 50 & 100 FOOT CANDLERS will give us 30, 40, 50 or more foot candles of illumination—and that's what we need for better, faster production."

WORKER—"Sounds good to me. I've worked under MILLER fluorescent and I know I've worked better and felt better simply because I could see what I was doing at all times clearly and sharply."

MAINTENANCE MAN — "Those lightweight Masonite reflectors MILLER uses will take plenty of punishment, and yet a girl can handle their cleaning. I like the exposed ballasts because they mean cooler operation. And I go big for that MILLER Patented Safety Lamp Lock that keeps lamps from falling."

ELECTRICAL CONTRACTOR — "I can handle the installation of MILLER equipment in less time, shorthanded as I am for trained help. Units go together easily into self-aligned runs. Hanging is simplified. I've had MILLER jobs result in installation savings of 30 to 50% to owners."

ARCHITECT — "I've specified MILLER Continuous Wireway Fluorescent Lighting Systems on both new construction and modernization projects. The beauty of it is its flexibility. Whole sections, or even the entire system can readily be moved to other parts of the plant."

UTILITY ENGINEER — "From power source right through to controls, the whole MILLER setup saves considerable critical material—and provides an adequate, modern lighting system . . . something we utility guys have been preaching for years."

OWNER — "You fellows hit both my pocketbook and my patriotism. I say let's specify MILLER 50 & 100 FOOT CANDLERS—and let's get a MILLER field man in pronto to talk turkey."

THE MILLER COMPANY • MERIDEN, CONNECTICUT

ILLUMINATING DIVISION
Fluorescent, Incandescent
Mercury Lighting Equipment

OIL GOODS DIVISION
Domestic Oil Burners
and Liquid Fuel Devices

ROLLING MILL DIVISION
Phosphor Bronze and Brass
in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION
War Material

MILLER
SINCE 1844

HEADQUARTERS for SHOP EQUIPMENT

For use where steel is war-restricted, we are now making "Hallowell" Duration Type Work-Benches, Stools, Tool Stands, etc. of wood.

Fig. 928. "Hallowell" Work-Bench with laminated wood top Drawer is extra. Pat'd and Pats. Pending.

Write for illustrated bulletins, then let us know your needs.

HALLOWELL

WORK BENCHES
OF STEEL

are made by specialists with years of experience in equipping shops and plants. That's why thousands of users all over the country think of "Hallowell" when they need shop equipment. The "Hallowell" is exceptionally strong and sturdy—built to stand firm and rigid without costly bolting to the floor. Available in over 1300 ready-made interchangeable combinations, readily adaptable to almost any job.

Also included in the "Hallowell" line are stools, foremen's desks, tool stands and other necessary pieces of equipment, all built along the same rugged lines as the benches—all available in a variety of styles and sizes.

"Hallowell" De luxe Shop Furniture for post-war use

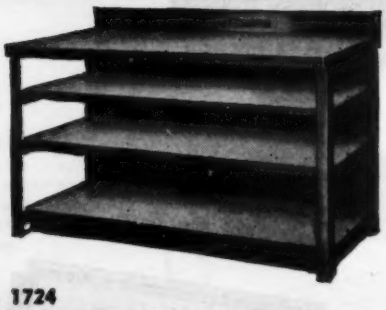


Fig. 1724
"Hallowell" Bench. Open unit — with backboard and three adjustable shelves.

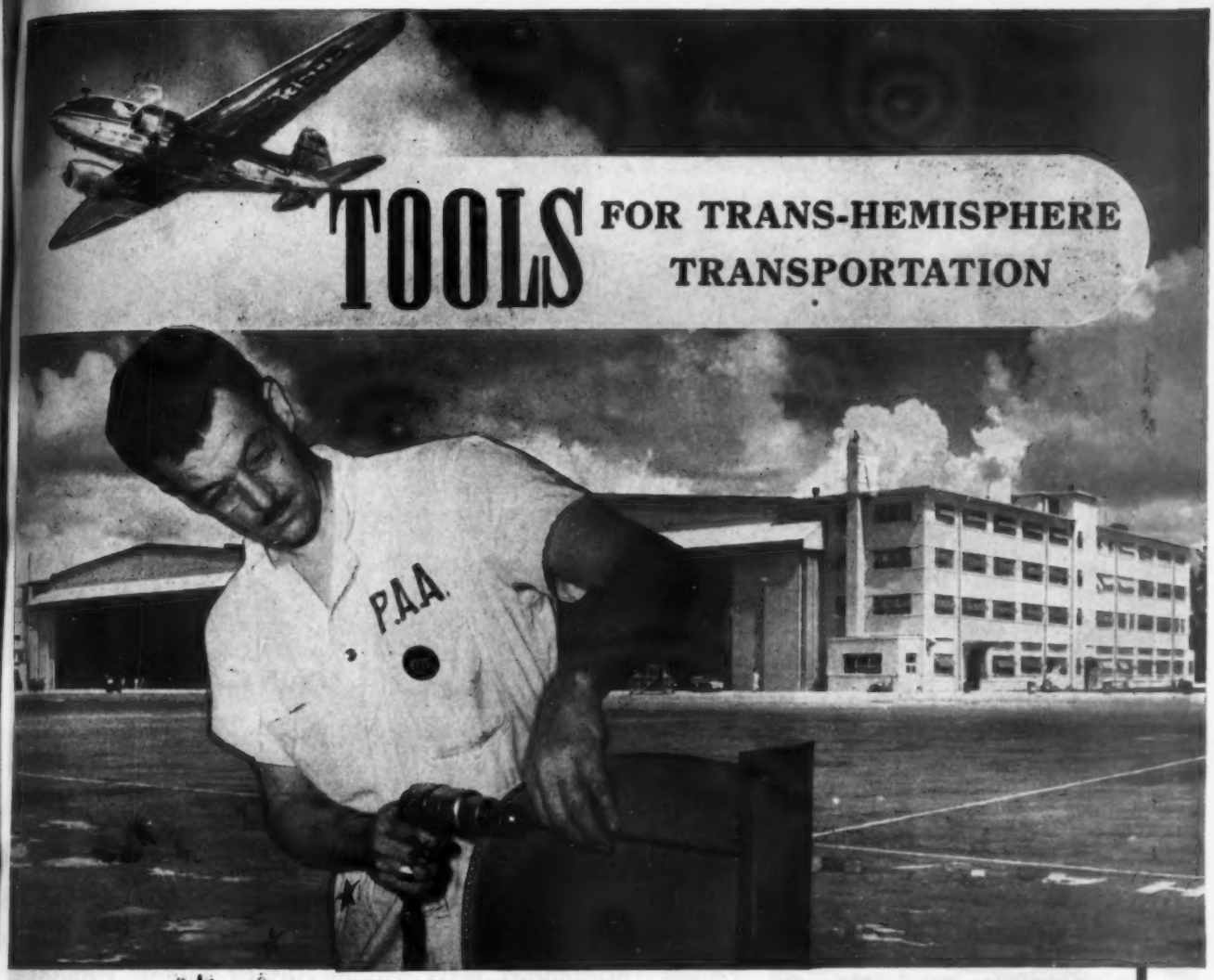
Designed to better meet specific functional needs of modern industry, "Hallowell" Deluxe Shop Furniture will be available shortly after the war. These new workbenches, desks, tool stands, chairs, etc. will have the same outstanding sturdiness and durability that characterize present "Hallowell" items. Their standardized construction with interchangeable shelf, cabinet and drawer units will meet practically any requirement.

Fig. 1734
"Hallowell" Bench, with backboard, lower shelf and two receding door cabinets, one unit open.

Over 40 Years in Business

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 846 · BRANCHES: BOSTON · DETROIT · INDIANAPOLIS · CHICAGO · ST. LOUIS · SAN FRANCISCO



TOOLS FOR TRANS-HEMISPHERE TRANSPORTATION

Because their routes are globe-shrinking in scope, Pan American World Airways must service their planes with the finest equipment. That is why Cleco Aircraft Tools are used extensively in Pan American maintenance work. Illustrated is a Cleco No. 123 Drill used at their huge new hangar at Miami.

Cleco tools for aircraft maintenance and production include literally hundreds of styles of drills, riveters, squeezers, screw drivers, nut setters, etc. We make Cleco Type "P" Sheetholders which are *triple-safe*—non-flying. Also immensely popular is the Cleco RIV-N-JECTOR—a rivet-holding magazine that reduces rivet dropping 90%. *Bulletin 85, enlarged and revised, describing all these products in detail, sent immediately upon request.*

POPULAR CLECO AIRCRAFT TOOLS

41C Squeezer

Riveter with BW Handle

9DP10 Drill

This BullDog Vacu-Break Switchboard controls blower operation. Note space for additional circuits.

Three BullDog Vacu-Break Switches are used in connection with the heat treatment of aircraft rivets.

PAN AMERICAN CHOSE *Vacu-Break*

BullDog Switches and Switchboards Control Light and Power Throughout New Million-Dollar Miami Hangar

Constructed as a unit, the new Miami building illustrated above, includes three four-story shop and office buildings divided by two hangars.

Largest and costliest of all structures in the far-flung Pan American World Airways System is this giant maintenance and office building — a monument to U. S. leadership in the skies.

That BullDog electrical equipment is used to control light and power throughout this giant aircraft center is a tribute of which we are proud.

Choice of switches, switchboards, panelboards for such great installations is not lightly made. Decisions are based on superior design, greater safety and dependability, longer life and lower upkeep cost.

BullDog meets these requirements squarely and completely — with the famous Vacu-Break principle which assures the most positive action, maximum safety and minimum wear.

Whatever the electrical problems of your plant or offices, BullDog engineers can contribute to the results you want. Write today for a descriptive booklet giving full information.

BULLDOG
ELECTRIC PRODUCTS CO.

BOX 177, R. PK. ANNEX
DETROIT 32, MICHIGAN
BullDog Electric Products of Canada, Ltd., Toronto, Ont.

Field Engineering Offices in All Principal Cities

In addition to Vacu-Break Safety Switches, BullDog Electric Products Company manufactures a wide variety of products for power distribution and control, including SafToFuse Panelboards, Circuit Master Breakers, Switchboards and the three famous Bus Duct Systems — BUStribution DUCT, *for "plug-in" power*, Universal Trol-E-Duct, *for flexible lighting*, and Industrial Trol-E-Duct, *for movable "loads."*

"DOING A PERFECT JOB REMOVING SOLDER FUMES!"

reports Mr. Harry Tendick, Maintenance Engineer

PROPELLAIR #CD24K FAN, 24" IN DIA., INSTALLED IN STACK, draws fumes through 24" x 24" air duct, underneath tables (85' long) extending both ways from stack. There are 44 inlets on each table (each fan). Each inlet spreads out from 3½" dia. at neck to slot or nozzle which is 1½" x 12". Each nozzle has a flaring edge through which air enters at 100 f.p.m. velocity.

SOLDER FUMES NEVER REACH WORKER'S FACE. Long narrow slot of intake gathers fumes before they reach breathing zone. An otherwise nasty job becomes pleasant work. Efficiency no longer impaired. Output increases. Health inspectors commend the performance of this installation.

PROPELLAIR FANS, COMPARED WITH CONVENTIONAL BLOWER-TYPE FANS, EFFECT SUBSTANTIAL SAVINGS IN BOTH OPERATING COSTS AND INSTALLATION COSTS

In the words of Mr. Tendick, Belmont's Maintenance Engineer, here is the result of a trial installation of Propellair Fans:

> "Our efforts were well rewarded. Since that experiment we have installed them (Propellair Fans) on all of our production lines and I can truthfully say they are doing a perfect job."

Belmont Radio Co., of Chicago, on the recommendation of the Cross Ventilating Co., made a trial installation of Propellair Fans two years ago. That they accomplished all Mr. Cross promised is proved by the fact that Belmont has installed them on all production lines.

FUMES, MOISTURE, DUST or *HEAT* present problems that are quickly and efficiently solved by Propellair's two exclusive features: Axial-Flow Airfoil Propellers and Curved Entrance Ring.

Solved not only in the most efficient manner but with Propellair Fans they are solved with an average 50% saving in operating costs and an average 20% saving in installation costs.

Submit your ventilating problems to the Propellair Fan Testing Laboratory where Propellair Engineers work continuously solving industrial ventilation problems. No obligation. Use coupon for complete information.

MAIL THIS COUPON TODAY!

EXCLUSIVE PROPELLAIR FEATURES

AXIAL-FLOW AIRFOIL PROPELLERS

Exclusive Propellair design results in airflow that is even over all parts of blade . . . not just tips. Non-overloading propellers give maximum air with minimum horsepower.

CURVED ENTRANCE RING

Eliminates air-flow restrictions almost 100%. Thus, full fan capacity is utilized and more air per horsepower is delivered.

PROPELLAIR INC.

"Moving Air Is Our Business"

SPRINGFIELD · OHIO

PROPELLAIR, INC., Springfield, Ohio (FM1)

Please send me complete information on Propellair Ventilating Equipment.

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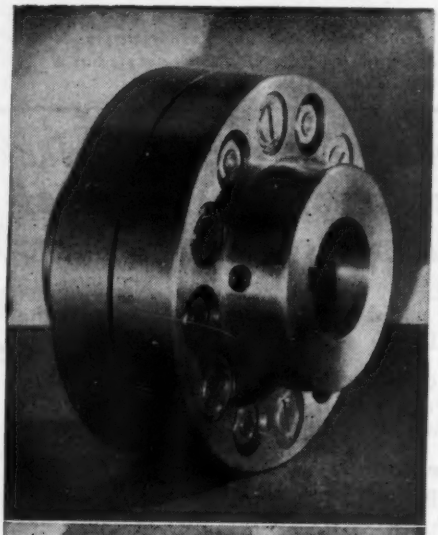

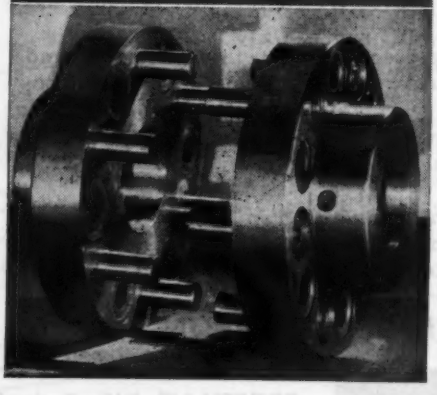

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A Psychologist Views Industry

WALTER J. COVILLE, Clinical Psychologist, Psychopathic Clinic, The Recorder's Court, Detroit

CURRENT DISCUSSIONS about manpower shortages lead one to ask, "Is industry utilizing available manpower most effectively?" Management is so concerned about production figures that it tends to overlook the industrial workers and the human factors that influence production. Union difficulties are accepted as necessary evils. Supervision is poor and greatly influenced by petty factory politics. Personnel departments consist of high school boys and girls who know little about personnel procedures. The idea prevails that proper selection and careful placement of workers are no longer feasible. The placement of large numbers on the payroll seems to be the accepted solution of industry's many problems. Workers, many of whom were in the lower income brackets prior to the war, are dissatisfied in spite of their high wages. Absenteeism, lagging production, increased accident rates, increased compensation costs, and labor trouble are almost taken for granted.

A few progressive plants, however, experience no manpower shortage and operate efficiently with a minimum number of employees; their production is ahead of schedule, workers are satisfied, injury and compensation figures are low. Management in these plants is on its toes and is utilizing specialized personnel to study factory problems and solve them. The one consistent finding of these plants is that the worker is responsible for some problems of industry and that the solution of these problems can be secured only through understanding and working with the individual worker.

The national emergency seems to have brought the conditions of our industries into the limelight. These conditions are not due to the war alone, for even in times of peace they existed and caused damaging results.

For proper selection and placement of workers, personnel men utilize psychological tests as an aid in evaluating the applicant. The company physician, a fixture in industry, eliminates the physically disabled at the time of hiring and also gives medical aid to workers injured on their jobs. In the more progressive plants, the industrial relations man introduces cafeterias, beauty shops, music, and recreational facilities in an attempt to provide ideal working conditions and thus to eliminate absenteeism, lagging production,

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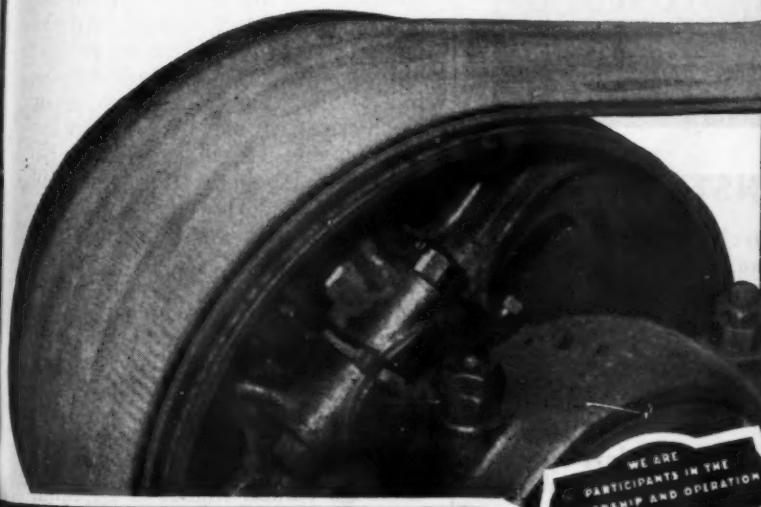

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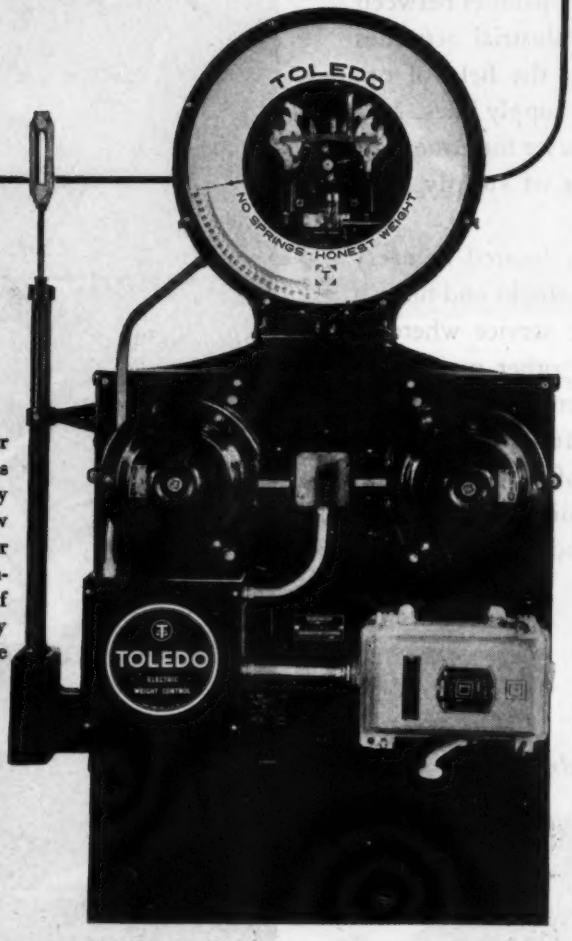

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fatigue. These innovations give the workers a degree of satisfaction never before attained in industry. However, is industry really getting at the basis of its problems in this manner or is it merely attempting to "sugar-coat" the employee for the duration?

Industry is a social organization, and its members are individual human beings, whose behavior in the plant is comparable to their behavior outside the plant. A trained worker, such as the clinical psychologist or psychiatrist, can predict an individual's behavior in the plant. Individuals differ from one another in many ways. They differ in innate intelligence, in basic skills, and in personality. Innate intelligence is measured by standardized intelligence tests and basic skills are measured by aptitude tests.

Personality, however, is inaccurately measured by personality scales. Objective testing to determine abilities and capacities is good as far as it goes—the trouble is that it does not go far enough. The individual as a social being cannot be evaluated by these tests; nor can his reaction to other workers or to plant situations be predicted.

The Clinical Approach

There seems to be one approach to this problem—the clinical approach, in which the individual is the point of departure. The total individual personality is studied, to determine the relationship among a number of factors that have played, or may play, a part in influencing individual behavior.

Germany approached its problems clinically. In the selection of officers, pilots, and military specialists it demanded an accurate character portrait of the candidate. In the early years before World War II, a group of six psychologists spent 11.5 hours in the examination of each candidate. No one will question the effectiveness of this procedure. However, under wartime conditions it was necessary to reduce to five hours the time devoted to each candidate, but, because there were not enough psychologists, this also was found to take too long.

In America, the military psychologists also considered the clinical approach, but we did not have the time. Our preparations for war had to be made almost overnight. To attempt thorough clinical studies of all candidates for the armed services would have been suicidal. The American psychologists did the next best thing. At the time of induction all candidates underwent psychiatric examinations; after induction they were given standardized tests and rated by trained observers.

In World War I, the Army learned the value of weeding out the misfits, who cost the government millions of

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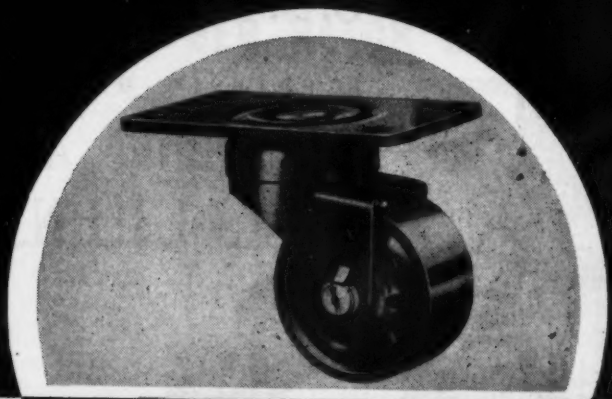

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dollars. Half of the Army hospital beds today, for example, are occupied by psychoneurotic cases, many of whom could have been kept off pension lists by adequate selection in 1917.

A military specialist, discussing those unfit for military service, states that of 10,000,000 men examined for the armed services by October, 1943, 2,000,800 men were classified 4F; of these, 30 percent were rejected for mental diseases and personality disorders. In Detroit, one induction station reports that in July, 1943, 9 out of every 100 selectees were rejected for personality disorders. Most of these rejectees are now in industry and are responsible for many problems.

Safety is one of these problems. Accidents are costly, not only in terms of dollars and cents but also in terms of production time lost. President Roosevelt, alarmed by the loss of industrial manpower caused by accidents, designated the National Safety Council to combat this menace. It took a war to make industry become safety-minded.

Accident Losses

In 1942 the man-days lost were estimated at 270 million. Of 47,500 working men and women accidentally killed in the United States, 18,500 died as a result of work accidents. A serious attempt is being made to reduce these alarming figures but the accident problem is still a major issue. In the Detroit area alone, within the first four months of 1943, 148 workers were killed, and 35 of these were killed on the job.

In normal times about 10 percent of the employees were responsible for 75 percent of all accidents. In times of war, because of the lowering of hiring standards, about 20 percent of the employees are involved in 75 percent of all accidents. Through proper management of this minority, industrial accidents can be decreased by at least 50 percent. Army rejectees enter private industry with little or no investigation as to mental or nervous stability, and become the weak spots in our industrial and social systems.

Employed as a safety man in one of Detroit's war industries, I had the opportunity to study the accident problem. Figures showed that between January, 1943, and May, 1943, out of approximately 6000 employees, 3540 suffered lost-time injuries, and, of these, 417 were accident repeaters, responsible for 2317 of the lost-time accidents. These accident repeaters were largely old employees—that is, old in terms of seniority. Also, the injuries were found to be due not to mechanical failures, but rather to personal failures, such as poor health,

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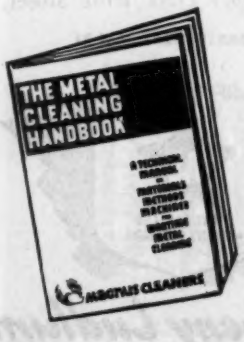

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mental or personality disorders, dissatisfaction on the job, personal and family troubles, and alcoholism of varying degree. The study furthermore showed that 7 percent of the total number of employees in this plant were accident repeaters, who accounted for 33 percent of the total number of lost-time accidents. Of the total number of workers injured, 52 percent were considered non-repeaters and were involved in 67 percent of the total number of lost-time injuries. The non-repeaters were largely new employees whose injuries were due to faulty training on the job. Of the total number of employees 41 percent were involved in no accidents.

This study further revealed that the accident-prone group was largely composed of maladjusted workers. Many of them suffered from a psychoneurosis; a few were psychotic; others were feebleminded, arteriosclerotic, alcoholic, or psychopathic personalities, either unstable or egocentric.

The above is not meant to indicate that Army rejectees or otherwise maladjusted workers are useless to industry. Many of them can perform their jobs satisfactorily, if their condition is known to the employer and provision is made for proper placement and treatment. Psychological study and treatment will go far in eliminating potential industrial liabilities.

Compensation Costs

Accident figures and compensation costs, as recorded by the safety engineer of the plant, indicate that improper selection and bad placement of workers are costly to industry. My experience with the accident problem convinces me that compensation costs could be reduced by at least 50 percent, if psychologists were utilized to interview applicants for jobs, accident-prone workers, troublemakers, and other maladjusted workers.

In one Detroit plant, which employed about 6000 workers, the severity rate (number of days lost per 1000 man-hours) was 2.6 and the frequency rate (number of disabling injuries per million man-hours) was 44.1 for a six-month period in 1943. The compensation costs for this period approximated $25,000 and another $24,000 for hospital costs. These figures indicate the direct cost of accidents. The indirect costs, resulting from loss of production, time lost by those helping the injured and those witnessing the accident, not to mention the psychological effect upon the other workers, can hardly be estimated. The time lost in this plant over this six-month period totaled 15,770 days.

First aid passes issued to workers also cause a loss of man-hours, often

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neglected in the computation of man-hour losses. Allotting 20 minutes for each pass issued, the man-hours lost totaled 13,000 hours!

Foremen selection and training is another duty of industrial psychologists. The foreman is a keyman in the plant. He is not only an expert at his job but also a leader of his men. Too many foremen are untrained or improperly trained in the psychology of supervision. This represents one of the most significant causes of dissatisfaction and poor morale among employees today. To illustrate, I observed the safety engineer himself reprimand a woman before her fellow-workers because she did not wear the proper head covering. The safety engineer used poor judgment and created a scene. He was "booed" by all workers in the department, and when he left all the women workers removed their caps. It took the safety man several weeks to restore order in this department.

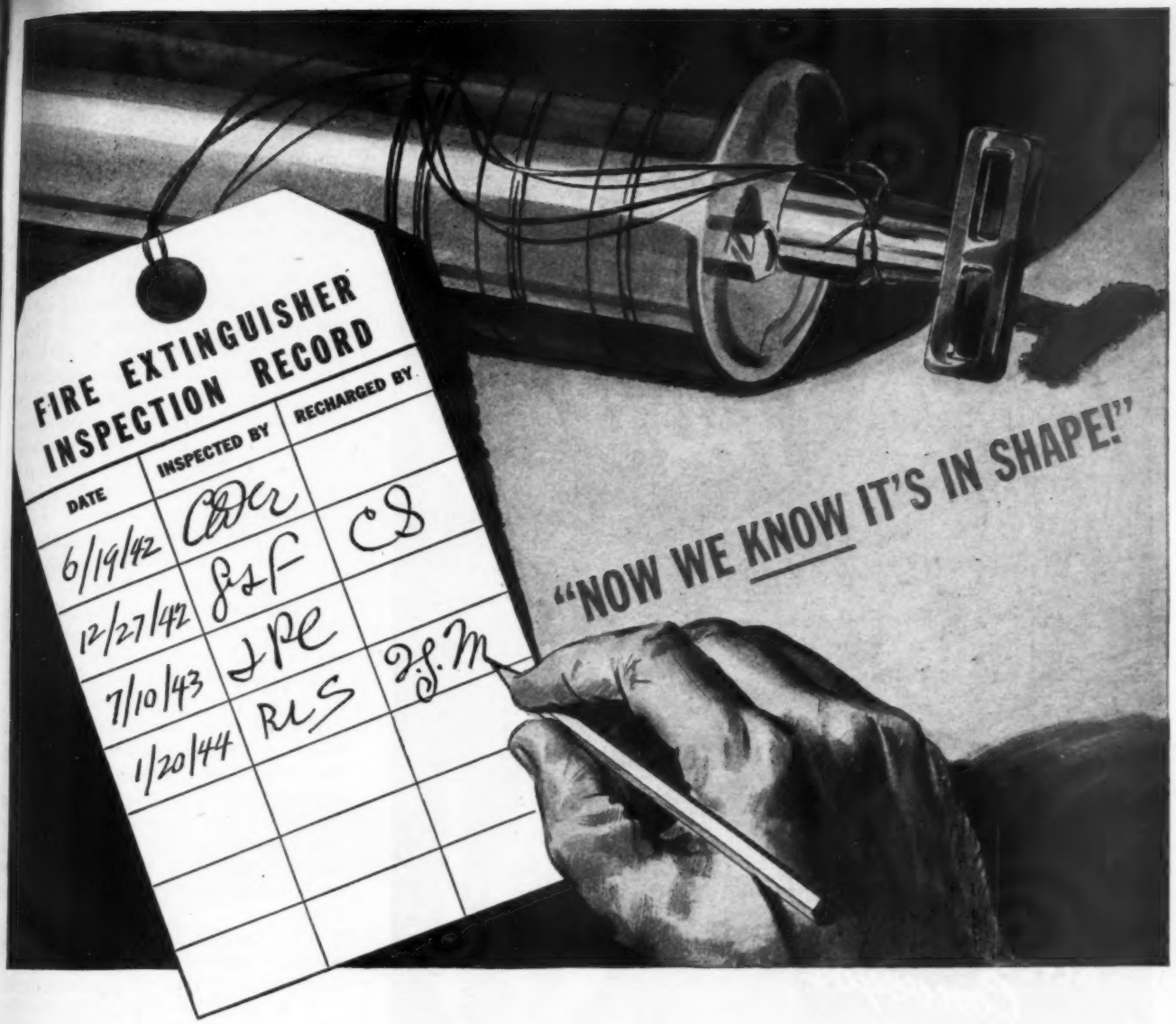
Foremen should be trained in spotting the maladjusted worker. The effects of maladjustment are far-reaching; for the individual worker, maladjustment means dissatisfaction, loss of incentive, and deterioration of health and character; for industry, it means increased accident rates, higher compensation costs, decreased production, costly labor turnover, plant inefficiency, and the probability of management-labor disputes.

My experience in industry indicates a special need for detecting the psychoneurotic, psychotic, arteriosclerotic, alcoholic, feebleminded, egocentric, and drug addict. Each of these personalities is discussed in the following pages, and examples are given to illustrate their adjustment in industry.

The Psychotic Worker

The incidence of psychoneurotics in industry is high. Among workers injured on the job, 20 percent were found to be suffering from psychoneurosis. Most of them were aware of their disorder, but did not know how or where they could get aid. In almost every instance, the worker was grateful for the opportunity to talk about his problems. He realized that, unless he were happy and well, he could not reach top efficiency, and also that his mental ill-health impaired the efficiency of fellow-workers.

Experience in industry convinces me that therapeutic interviews by the clinical psychologist aid the psychoneurotic in making a better adjustment. The more severe cases of psychoneurosis should be treated by a company psychiatrist, or be referred to an outside psychiatrist if the company does not provide psychiatric treatment. Even the mildest cases of psycho-



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neurosis show an appreciable decrease of personal efficiency, and are most likely to be injured on the job.

Psychoneurotic predisposition is determined to some extent by unfavorable home life, chronic disease, sex conflicts, financial difficulties, and restricted outlets. Common factors precipitating psychoneurosis are sex conflicts, marital crises, financial crises, operations, illness or death in the family. The psychoneurotic is usually overconcerned about his illness; he has many somatic complaints. He is anxious and preoccupied with the future. His fears may include the fear of disease, death, insanity, and the like. The pre-hospital psychoneurotic usually has consulted many physicians and has undergone an operation or two; he uses various kinds of sedatives and often consults quacks.

The psychoneurotic reaction types are usually classified as anxiety, hysteria, and compulsion types.

The most important feature of an anxiety psychoneurosis is morbid anxiety or fear. A general nervous irritability or excitability is in evidence. The psychoneurotic may complain of a heart disorder, shortness of breath, blurring of vision, dizziness, trembling, sweating, nausea, vomiting. An industrial worker suffering from this type of psychoneurosis is maladjusted on his job, causes a wastage of material and a lag in production, he is an accident repeater, and is frequently absent from work.

The case of R. F., a 36-year-old hammer man in the forge plant, well illustrates this type of psychoneurosis.

R. F. was referred to me by the first aid nurse with the complaint that within the first four months of 1943 he had 12 injuries. The 1942 record showed 16 injuries, which included two hospital trips, one for the amputation of the right index finger and the other for surgical repair of a finger partially torn off.

This worker realized his shortcomings and feared another serious injury. Although considered one of the best hammer men in the forge department, he was becoming "hammer shy."

The examination revealed a highly egocentric worker, compensating for his short stature. His foreman described him as irritable, stubborn, reckless, and a troublemaker. On one occasion he precipitated a sit-down strike in the department by teasing colored workers who were heaters and assistants to hammer operators, all of whom were white. The colored workers insisted on the hiring of several colored hammer operators and, claiming race discrimination, struck in protest. Production in this department stopped, and hammers were idle for two days. The militia were summoned and the

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colored workers were told to evacuate the plant or work. They chose to work.

The predisposing factor to R. F.'s psychoneurosis was an unfavorable early life. He was raised in an orphanage and never knew his parents. At the age of 15 he ran away from the orphanage and for 15 years he wandered about the country doing odd jobs. Coming to Detroit five years ago, he married and settled here permanently.

R. F. had marked inferiority feelings based on his short stature. To compensate for this, he was aggressive and was involved in many disputes with fellow-workers. When first employed, he insisted on operating the largest hammer because of the feeling of power and accomplishment it gave him.

The chief feature of this worker's psychoneurosis was his fear of death. He complained of kidney trouble and of sharp pains in the heart region. These pains frightened him, and he described his fear as a "death complex." He traced back his fear of death 16 years when he was thrown out of a boat and almost drowned. He admitted that at times when he was operating the hammer the fear of death forced him to leave the hammer for a few minutes. He also had a fear of height which dated back six years when he fell from a board hammer. Furthermore, he was subject to epileptiform seizures which occurred suddenly and were usually precipitated by excitement.

This worker, suffering from a psychoneurosis of the anxiety type, was definitely a compensation risk. In addition, by virtue of his compensatory behavior, he was a trouble-maker in the department. Several interviews were had with him and an attempt was made to give him insight into his condition. He was grateful for this and cooperated well. With the foreman's help, a plan was worked out whereby R. F. was transferred from the hammer to stockchasing for a trial period. The worker welcomed the transfer and made an excellent adjustment. He felt that his new job was a promotion, and this satisfied his ego. He was also referred to a psychiatrist for further treatment.

This case clearly illustrates what damage the psychoneurotic can cause in industry. Most often he is a compensation risk. The case further exemplifies the work of the psychologist who can make the diagnosis, offer treatment, and often, with the aid of the foreman, effect an adjustment.

The Psychotic Worker

The psychotic in industry is not so prevalent as the psychoneurotic, but weeding out these personalities is im-

I PREDICT...

by Raymond Loewy
Noted Industrial Designer

After the war you will travel more than you ever have. And one of the developments that will make it possible is the new helicopter air bus. This remarkable aeronautical achievement ushers in a really new mode of transportation that will enable you to make short air trips quickly, inexpensively and in complete comfort. Present bus terminals will be adapted as landing ports and maintenance hangars so you will take off and arrive in central sections of cities and towns. The multi-passenger helicopter air bus, already endorsed by authorities as entirely practical, will bring air travel to millions of persons and thousands of communities that now lack this form of transportation. When you buy War Bonds today remember they will enable you to experience this and many other marvels in tomorrow's world!

Note: The Weatherhead Company, one of the oldest and most important manufacturers of parts for the aviation industry, is prepared for the day when its four plants will again be contributing to aviation's peacetime needs.

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Manufacturers of vital parts for the automotive, aviation, refrigeration and other key industries.

Plants: Cleveland, Columbia City, Ind., Los Angeles
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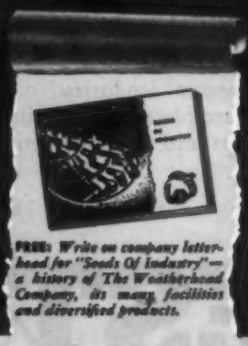

FREE: Write on company letterhead for "Seeds Of Industry"—a history of The Weatherhead Company, its many facilities and diversified products.

portant. One personnel manager admitted that during a period of one year he hired at least a dozen individuals who soon after proved to be psychotic. He agreed that hiring such workers is costly and detrimental to plant efficiency. In the psychoneurotic, the personality is only partially altered, and there is contact with reality, whereas, in the psychotic, the entire personality is profoundly shaken, and there is a definite split between the individual and environment. As a rule, the psychotic or prepsychotic personality is easily recognized by the trained worker.

Endangers Others

Psychotic disturbances of personality affect the individual's adjustment in every aspect of life. In industry, where the worker is under pressure and where good adjustment is essential, the psychotic worker not only suffers many injuries and is a compensation risk, but he also endangers the safety of other workers.

The following example illustrates the need for clinical psychologists in a personnel department.

S. K., a middle-aged man, was hired by the personnel manager and almost immediately was sent out to work on the assembly line. The foreman noticed that the man gave little attention to instructions for a routine job. On the job not more than 15 minutes, S. K. told his fellow-workers that "they got in," and he became very excited. The foreman, who attempted to quiet S. K. was called a "dirty spy!" Soon the entire department became full of spies, and our newly hired assembly worker was forcibly taken to the personnel office, where he was given his discharge and sent away.

On another occasion a lathe operator was referred to me by a foreman, who complained that the operator spent most of his time looking at the ceiling, and that he acted "crazy." My examination revealed that the worker was suffering from a psychosis, paranoid type, to a committable degree. He complained that he had been followed to work every day for the past month by colored workers, who were "after him." He had been seen watching a knothole in the floor through which, he explained, the muzzle of a gun was pointed at him. I discovered during the interview that he had been paroled from a state hospital about a year ago. This man was a witness to the Detroit race riot in June, 1943, and it is most likely that his psychotic state was precipitated by that unpleasant experience.

(The second installment of Dr. Coville's article will be published in the April issue.)

There's a difference in Morale..

when Washrooms are Sanitary

The war has emphasized the importance of protecting workers' health and welfare. Management recognizes more than ever before how much health and morale affect the speed and cost of production.

West bowl-cleaner service and deodorizing equipment are primary requisites to the maintenance of wholesome sanitary washrooms.

WEST BOWL CLEANER SERVICE. West has organized an "army" of trained service men to operate from its branches from coast to coast. They are experienced in using the proper products in the most efficient manner and on a periodic schedule. Thus management may relieve their maintenance crews of this necessary duty and be assured that it will be efficiently and regularly taken care of.

WEST AUTOMATIC DRIP MACHINES are designed to meet the need of proper washroom deodorization in a simple, economical and efficient method. They are placed above toilets and urinals so that an aromatic liquid constantly drops into the bowl, tending to overcome washroom odors at their source.

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BRAKE SHOE WARS ON WEAR

Announces research group to make vital parts last longer

For years, Brake Shoe in all of its divisions has been fighting to reduce losses caused by wear; heat, friction, impact, corrosion, abrasion and stress — wear from whatever cause.

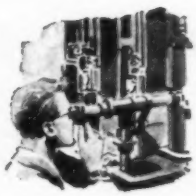
Now such activities have been augmented and strengthened by centralization of experimental engineering under the direction of a Research Group at Mahwah, N. J.

While activities of this Research Group cover a wide range of industrial problems, their immediate responsibility is to carry on relentless war on wear.

In nearly every machine there is a "punished" part — a place where wear is greatest.

Often a manufacturer's success depends upon his ability to improve that particular "punished" part.

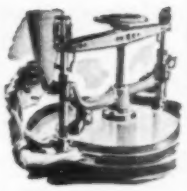
It is Brake Shoe's business to *know* the best material for each "punished" part and *how* to produce that material economically.

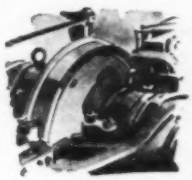


If existing materials are not good enough the Research Group endeavors to design better ones.

If design is faulty, Brake Shoe engineers can offer sound suggestions for changes.

Brake Shoe focuses *on one part* the effort that the manufacturer, for cost reasons, must spread over the *whole* machine.





The result? A better product . . . often at lower cost.

The resources of the Brake Shoe Research Group — unique we believe in this country — are available to manufacturers whose production calls for large runs of standardized parts.

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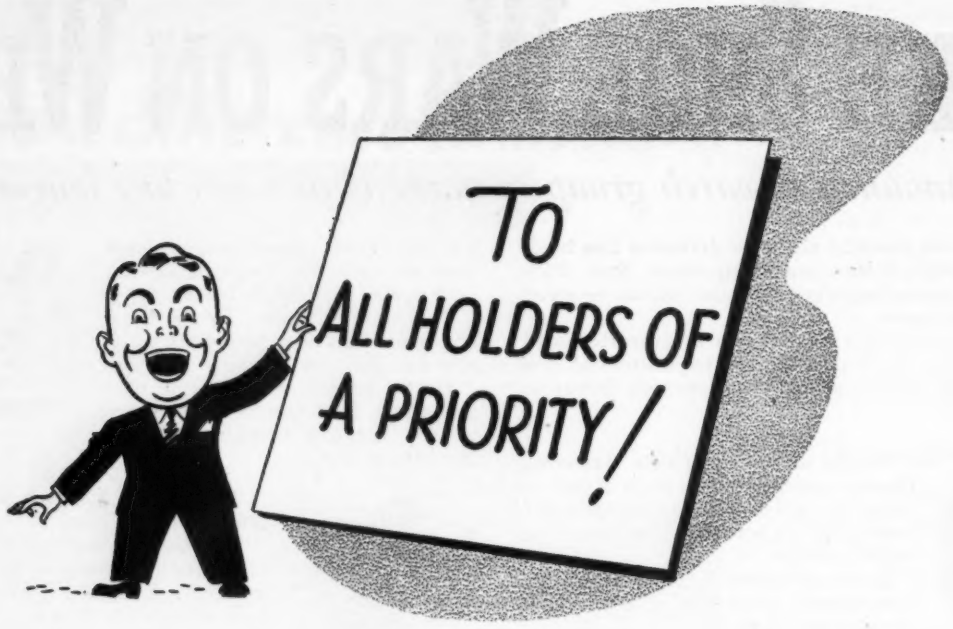

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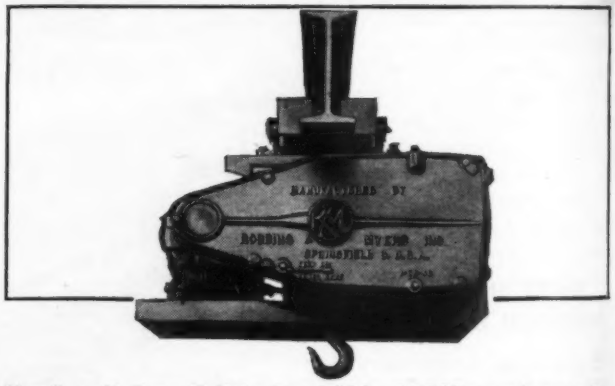
GET R & M HOIST DELIVERY *promptly!*

Eliminating the need for "muscle" on many jobs, R & M Hoists suit today's production requirements. Their simplicity of operation offers increased output . . . with less fatigue for inexperienced workers—with greater benefit to management.

In a short time, you can make the most of your manpower. You can move materials faster and easier with fewer men when you use an R & M Hoist. Two of the many hoists available for quick delivery are shown below.

The R & M Type F½ Hoist has 1,000—2,000-pound capacity. It is provided with pendent, push-button control. A step forward in improved design, better materials, and manufacturing economies that provide a better hoist at lower cost in both purchase price and operation.



The R & M Type F Hoist has 1,000—15,000-pound capacity. Push-button control is standard. Operating with low headroom and handling loads from any angle with perfect balance, the Type F Hoist makes a one-man job of many otherwise cumbersome operations.

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Cincinnati . . . . . 418 New St.	Meriden, Conn. . 135 Colony St.	Seattle . . . . . 216 Walker Bldg.
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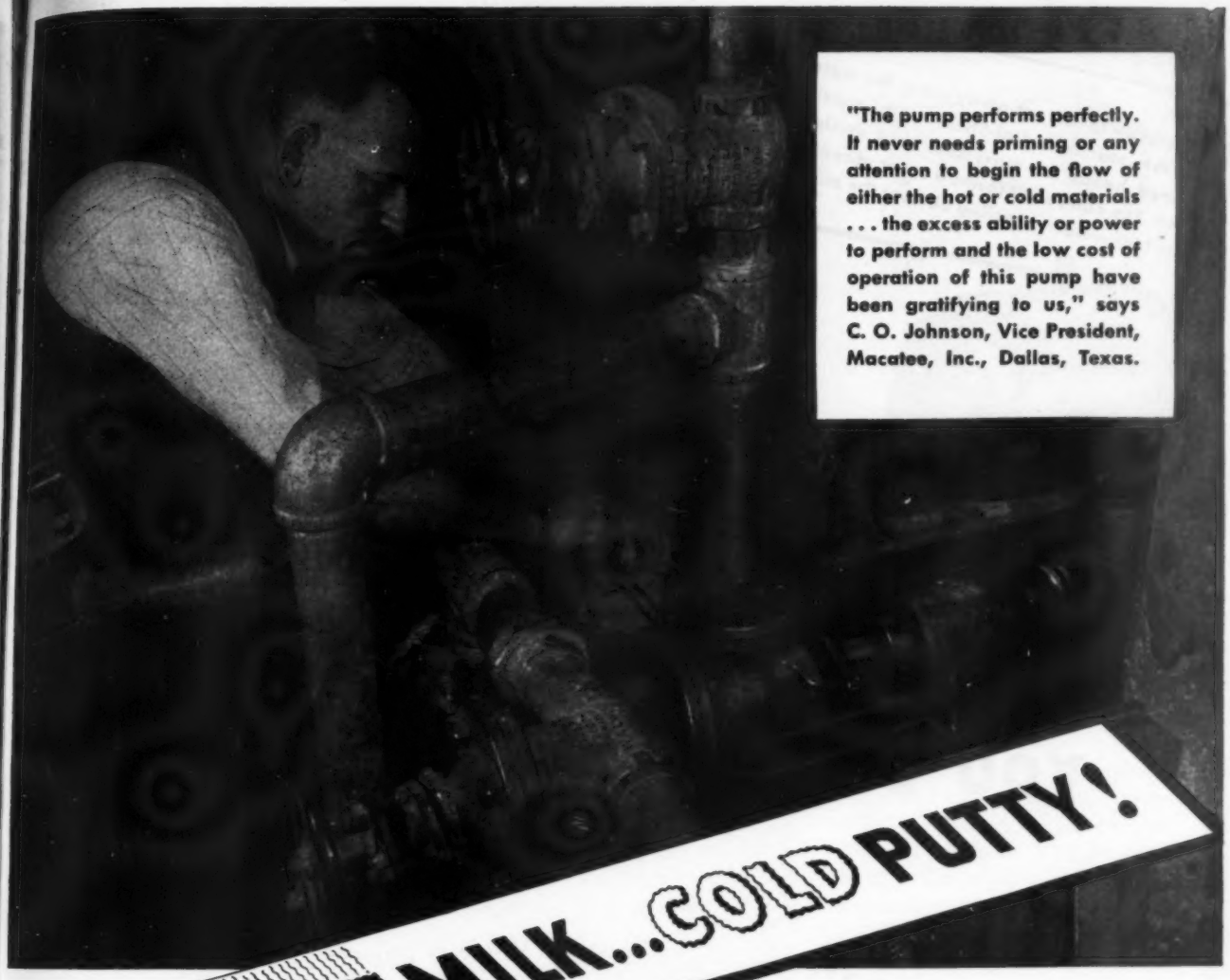

"The pump performs perfectly. It never needs priming or any attention to begin the flow of either the hot or cold materials . . . the excess ability or power to perform and the low cost of operation of this pump have been gratifying to us," says C. O. Johnson, Vice President, Macatee, Inc., Dallas, Texas.

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...1 R&M MOYNO PUMP handles these 2 tough forms of lime for Macatee, Inc.

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First, lump lime is slaked. And while at a temperature of 215° F. this milk of lime is drawn through the pump from 60 feet away and lifted to a head height of 30 feet for storage in steel tanks.

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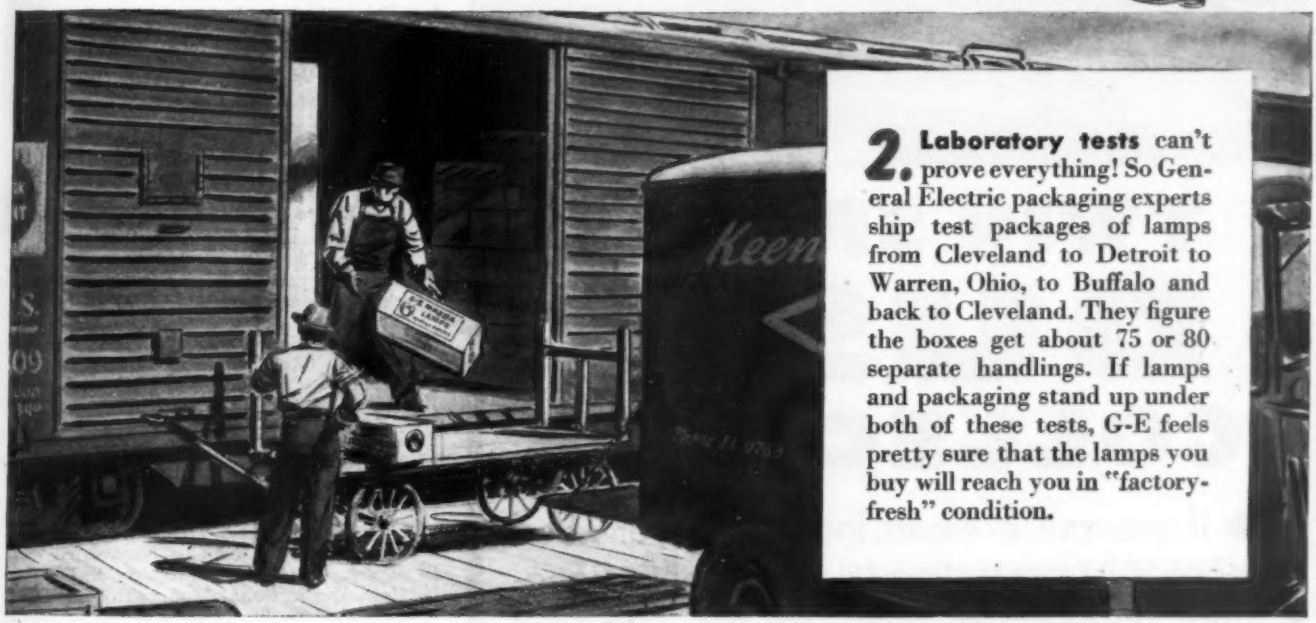

2. Laboratory tests can't prove everything! So General Electric packaging experts ship test packages of lamps from Cleveland to Detroit to Warren, Ohio, to Buffalo and back to Cleveland. They figure the boxes get about 75 or 80 separate handlings. If lamps and packaging stand up under both of these tests, G-E feels pretty sure that the lamps you buy will reach you in "factory-fresh" condition.

3. These are just a couple of the more than 480 tests and inspections given to G-E Mazda lamps. Why all these tests? Simply to insure uniform high quality and reliability in every lamp wearing the G-E monogram, whether a special lamp for war or the G-E lamps you use in your plant.

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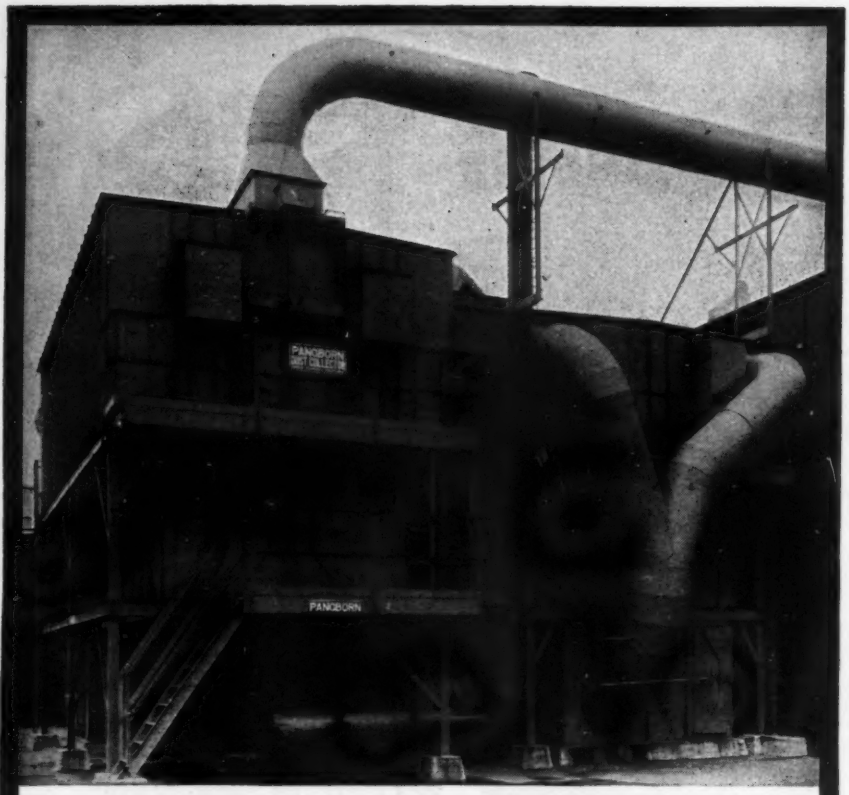

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Phil Carroll, Jr., Management Consultant. McGraw-Hill Book Co., 330 W. 42nd St., New York 18. 172 pages. Drawings, tables, index. $1.75.

According to Glenn Gardiner in a foreword, "this book is written to give the practical foreman a working knowledge of the elementary principles involved in studying and measuring the time it takes to do a job." Fourteen chapters, including "What Timestudy Gives to Industry," "Why Foremen Should Understand Timestudy," "How to Begin a Timestudy," "How to Set Consistent Element Times," "How to Set Standards," and others.

MAINTENANCE AND SERVICING OF ELECTRICAL INSTRUMENTS

James Spencer, Instrument and Relay Department, Westinghouse Electric & Mfg. Co., Newark, N. J. The Instruments Publishing Co., 1117 Wolfendale St., Pittsburgh 12. 256 pages. Photographs, drawings, index. $2.

Covers construction, testing, applications, principles of operation, and maintenance of all kinds of electrical instruments. Intended for use in instrument schools, and for instrument users, switchboard attendants, testing engineers, and instrument service men. In twelve chapters, covering "Direct-Current Instruments," "A. C. Ammeters and Voltmeters," "A. C. Wattmeters," "Brief Summary of A. C. Types," "Instrument Transformers," "Frequency Meters," "Synchroscopes," "Power Factor Meters," "Reactive Factor Meters," "Dial Marking," "Plug-In or Detachable Instruments," "Pivots and Bearings."

GUIDE TO METHODS IMPROVEMENT

Harold B. Maynard, President, Methods Engineering Council, and G. J. Stegemerten, Staff Supervisor, Industrial Methods Engineering Dept. Westinghouse. McGraw-Hill Book Co., 330 W. 42nd St., New York 18. 85 pages. Index. $1.

Shows how, by systematically asking the "why" of every operation element in any type of plant, many improvements in methods and production may be made. Indicates the ten points of opportunity for improvement, gives more than 400 specific questions that may be applied to these points.

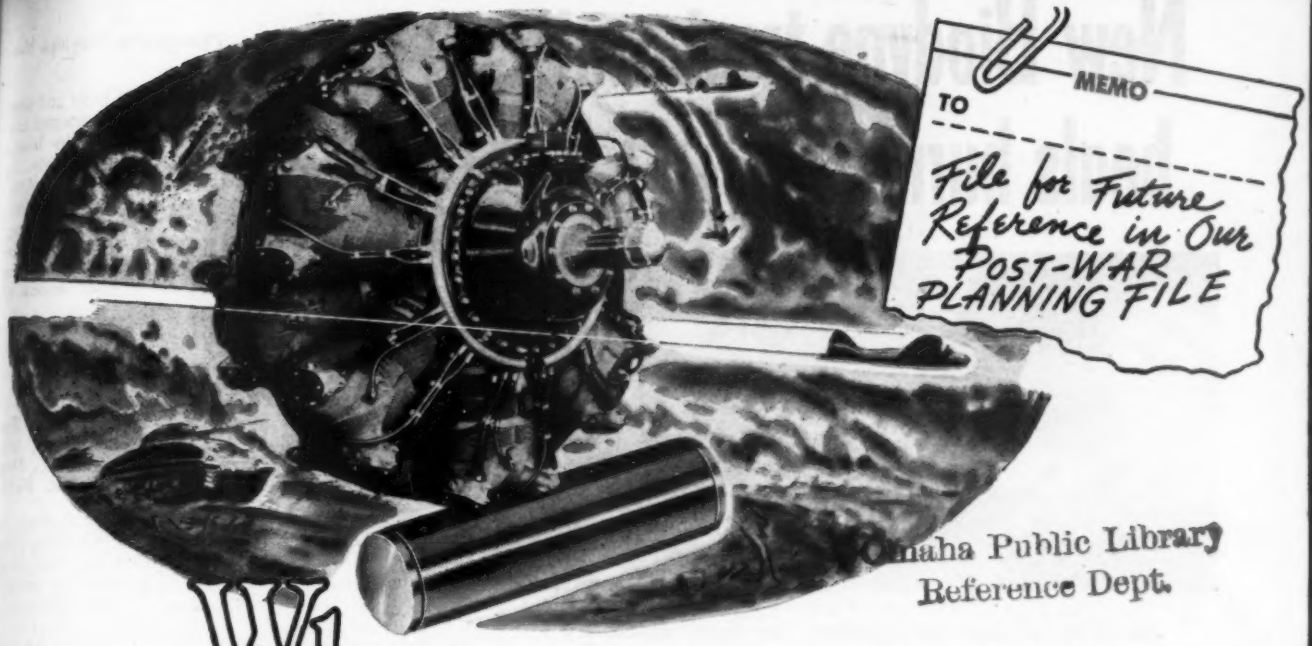
FUNDAMENTALS OF MECHANICAL INSPECTION

Rolland Jenkins, Inspection Supervisor, Sperry Gyroscope Co., Brooklyn, N. Y. McGraw-Hill Book Co., 330 W. 42nd St., New York 18. 179 pages. Photographs, drawings, index. $1.75.

For trainees and junior inspectors, handbook covers the how and why of inspection. Principles and uses of fine tools and precision instruments are discussed.

BLUEPRINT READING

Fred Nicholson, Mechanical Drawing Instructor, Henry Ford Trade School, and Fred Jones, Head of Drawings Department, Ford Motor Co. Apprentice School, Dearborn, Mich. D. Van Nostrand Co., 250 Fourth Ave., New



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George Tharratt, Chief Engineer, Adel Precision Products Corp., Burbank, Calif. McGraw-Hill Book Co., 330 W. 42nd St., New York 18. 201 pages. Drawings, index. $3.50.

Text and reference manual for students in perspective layout, technical sketching, and the basic principles of production illustration. History of production illustration, its present and future potentialities in the preorganization and operation of fast moving production lines, and suggestions for the introduction of this method into existing engineering and manufacturing organizations are included.

BOOKLETS

PUTTING THE DISABLED VETERAN BACK TO WORK. Special Series, Bulletin No. 2. A panel discussion by C. D. Selby, M.D., General Motors Corp.; Col. John N. Andrews, Executive Officer, Reemployment Division, National Selective Service System; A. A. Hendrix, Eastern Aircraft Div., General Motors Corp.; I. Dent Jenkins, Harrison Radiator Div., General Motors Corp. Industrial Hygiene Foundation, 4400 Fifth Ave., Pittsburgh 13. 24 pages. Prices on request.

EMPLOYEE COUNSELING. Helen Baker, assistant director, Industrial Relations Section, Department of Economics and Social Institutions, Princeton University, Princeton, N. J. 64 pages. $1.

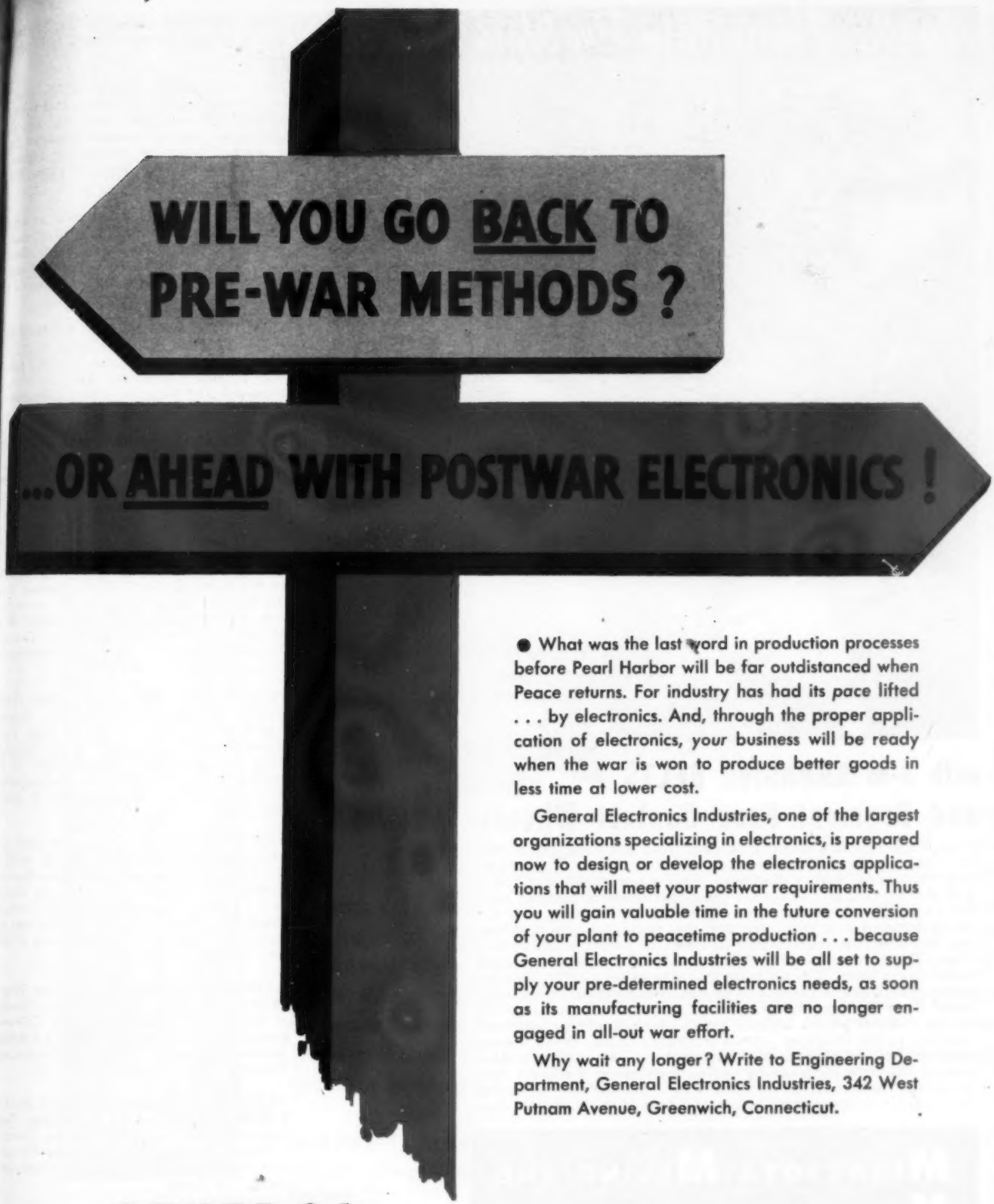
TRAINING FOR MORALE. Production Series No. 147. Albert Walton, American Viscose Corp.; H. B. Schmidhauser, The Hammarlund Mfg. Co.; T. O. Armstrong, Westinghouse. American Management Association, 330 W. 42nd St., New York 18. 24 pages. 50c.

A SHORT-TERM TRAINING PROGRAM at Armco Drainage and Metal Products, Inc., New Orleans, La. Apprentice-Training Service, Bureau of Training, War Manpower Commission, Washington, D. C. 5 pages. Exhibits. No charge.

POST-WAR TAX POLICY AND BUSINESS EXPANSION. Lewis H. Kimmel. The Brookings Institution, Washington 6, D. C. 46 pages. Tables, appendix. 50c.

EMERGENCY TRAINING PROGRAM, Westcott Valve Co., East St. Louis, Ill. Apprentice-Training Service, Bureau of Training, War Manpower Commission, Washington, D. C. 12 pages. Letters of approval, list of technical publications of Apprentice-Training Service, list of regional offices. No charge.

THE SMITHS AND THEIR WARTIME BUDGETS, Maxwell S. Stewart. Public Affairs Pamphlets No. 88. Public Affairs Com-



● What was the last word in production processes before Pearl Harbor will be far outdistanced when Peace returns. For industry has had its *pace* lifted . . . by electronics. And, through the proper application of electronics, *your* business will be ready when the war is won to produce better goods in less time at lower cost.

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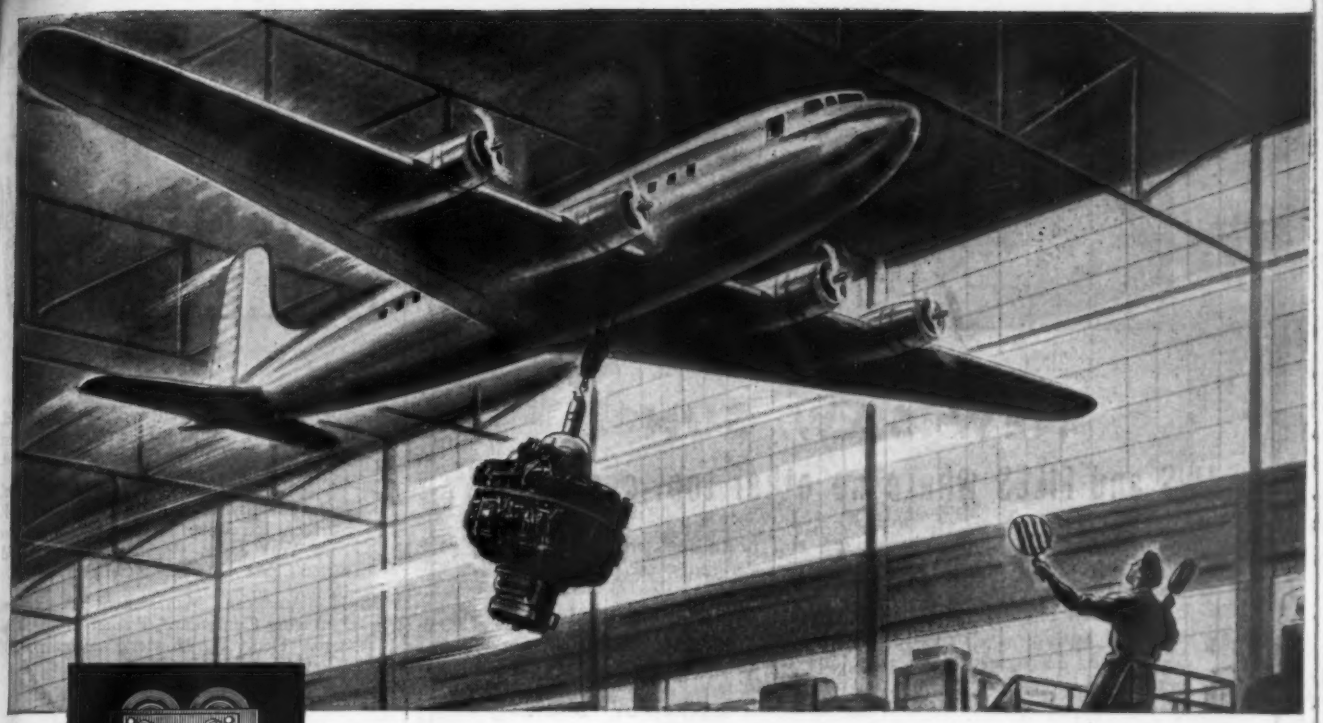

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ON THE CALENDAR

MARCH

26–28, American Society of Tool Engineers, Annual Meetnig, Bellevue-Stratford Hotel, Philadelphia. Adrian L. Potter, Executive Secretary, 2567 West Grand Blvd., Detroit.

28–30, Safety Engineers, Annual Convention, Hotel Pennsylvania, New York. Paul F. Stricker, Executive Vice-President, Greater New York Safety Council, Lincoln Building, 60 East 42nd St., New York.

28–31, American Management Association, Packaging Conference, Palmer House, Chicago. Henry J. Howlett, Secretary, 330 West 42nd St., New York.

APRIL

3–5, American Society of Mechanical Engineers, Spring Meeting, Hotel Tutwyler, Birmingham, Ala. Ernest Hartford, Executive Assistant Secretary, 29 West 39th St., New York.

3–7, American Chemical Society, Spring Meeting, Hotel Statler and Hotel Cleveland, Cleveland. Alden H. Emery, Assistant Secretary, 1155 Sixteenth St., N. W., Washington, D. C.

13–14, Midwest Power Conference, Palmer House, Chicago. Stanton E. Winston, Conference Director, Illinois Institute of Technology, 3300 Federal St., Chicago.

19–20, American Management Association, Production Conference, Hotel Drake, Chicago. James O. Rice, Manager, 330 West 42nd St., New York.

24–28, National Electrical Manufacturers Association, Spring Meeting, Palmer House, Chicago. R. J. Blais, Convention Manager, 155 East 44th St., New York.

25–27, Chamber of Commerce of the United States, 32nd Annual Meeting, New York. Ralph Bradford, General Manager, 1615-H St., N. W., Washington, D. C.

28, Association of Consulting Management Engineers, Spring Meeting, Union League Club, Chicago. Nathaniel W. Barnes, Executive Secretary, 347 Madison Ave., New York.

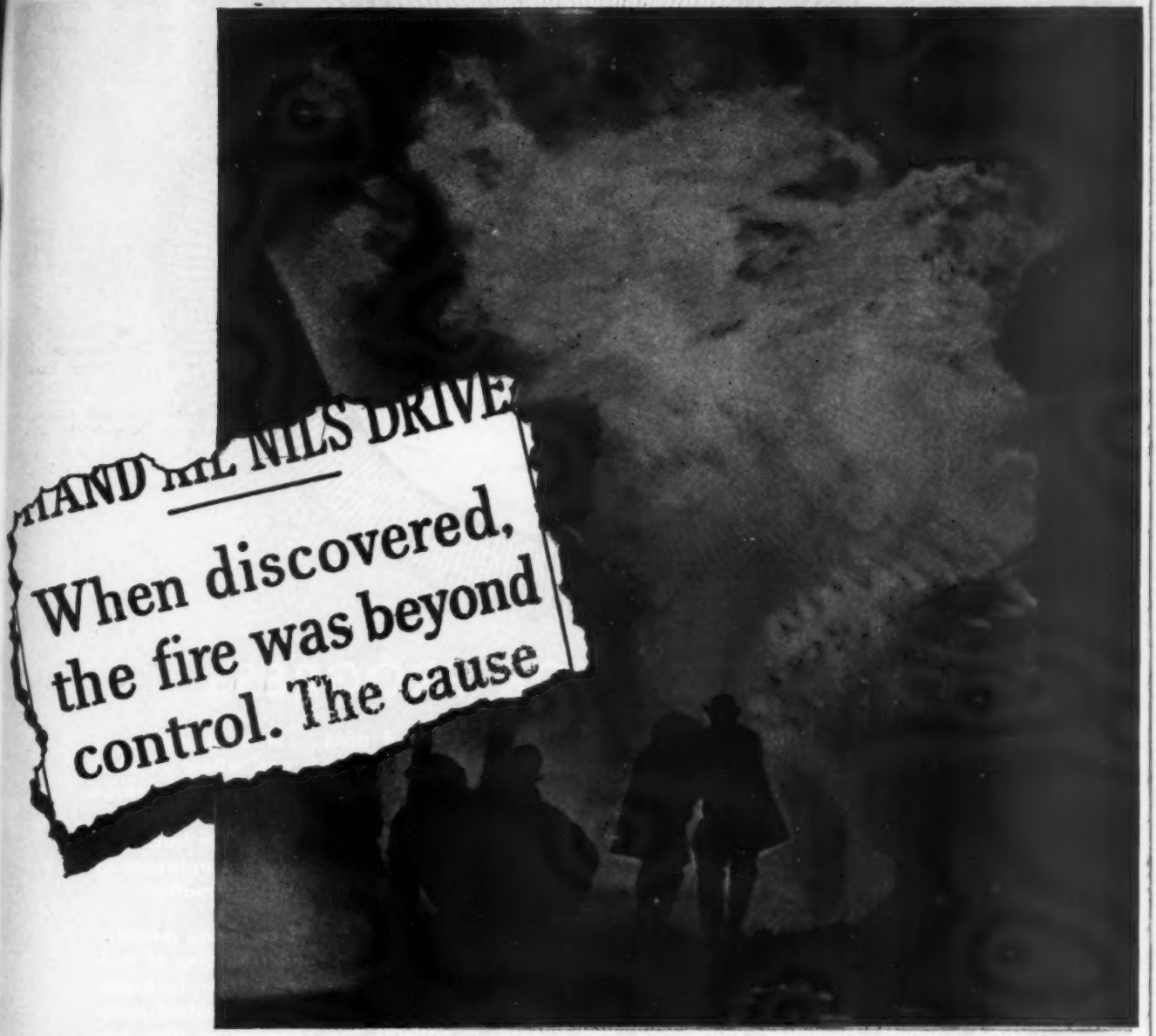
MAY

8–11, National Fire Protection Association, Annual Convention, Benjamin Franklin Hotel, Philadelphia. George W. Elliott, Secretary, 1129 Walnut St., Philadelphia.

14–16, American Institute of Chemical Engineers, Semi-Annual Meeting, Hotel Cleveland, Cleveland. S. L. Tyler, Executive Secretary, 50 East 41st St., New York 17.

16–19, National Metal Trades Association, 46th Annual Convention, The Biltmore, New York. Charles L. Blatchford, Assistant to the Commissioner, 122 S. Michigan Ave., Chicago 3.

29–31, National Association of Purchasing Agents, Annual Convention, Waldorf-Astoria Hotel, New York. G. A. Renard, Executive Secretary-Treasurer, 11 Park Place, New York 7.



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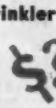

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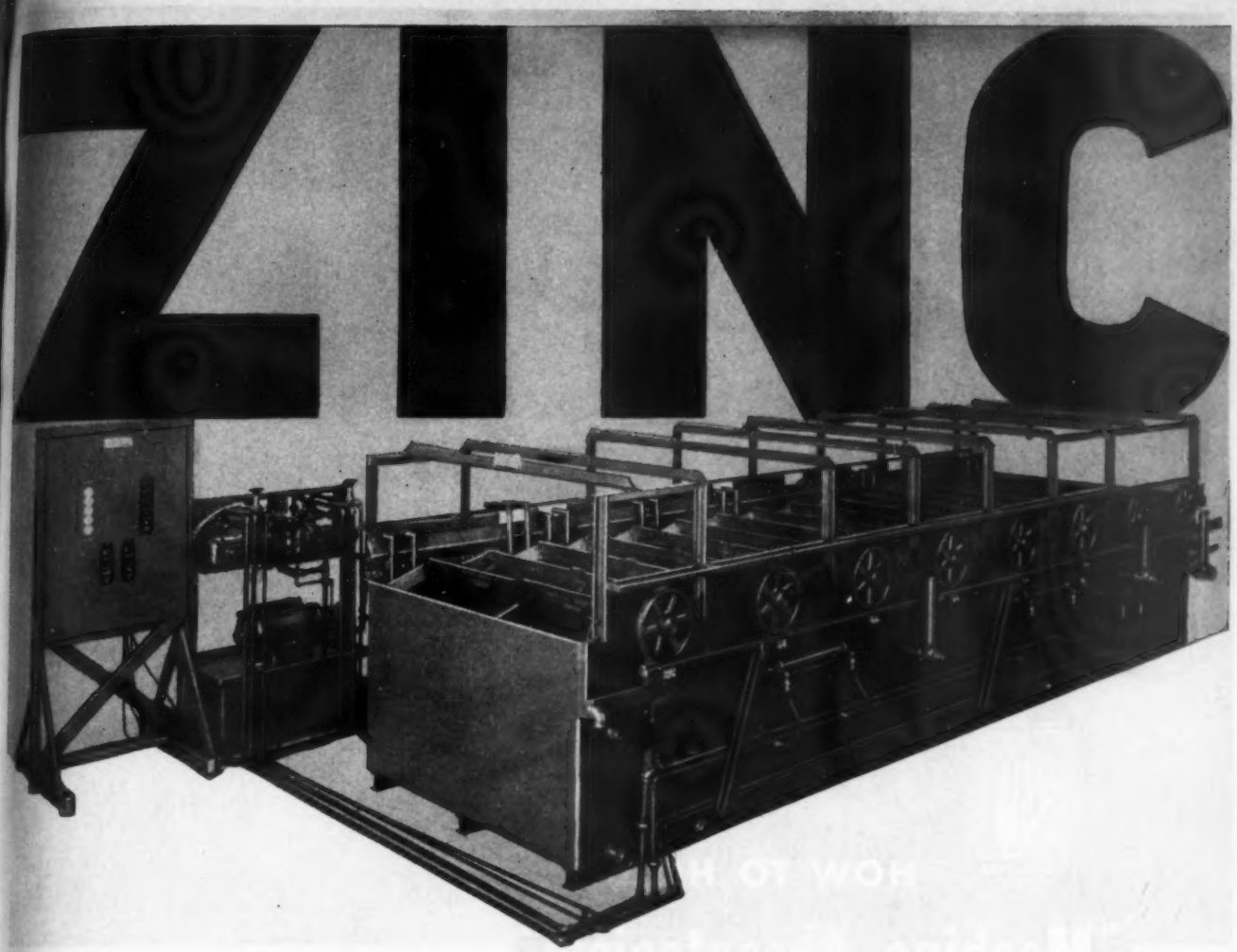

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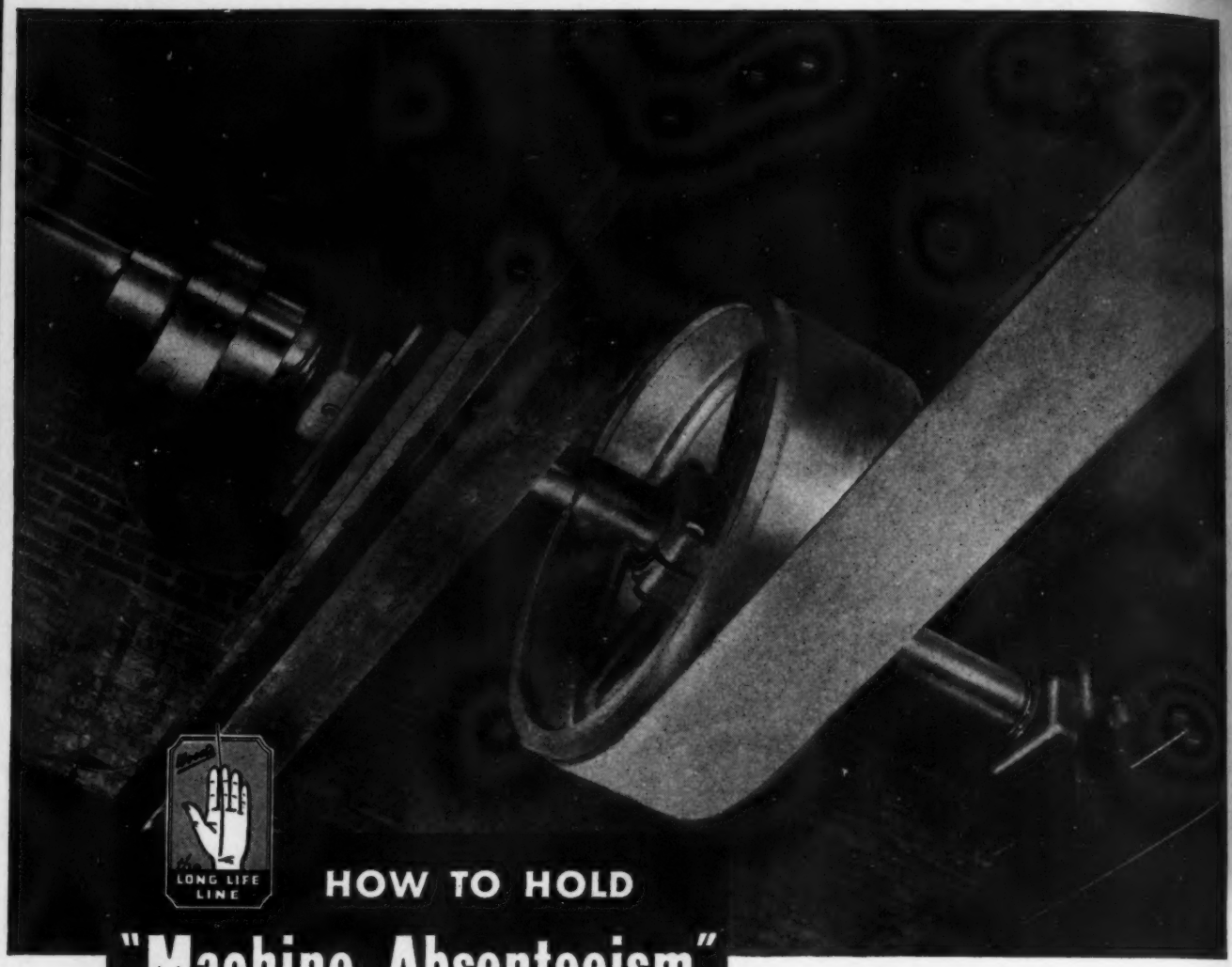

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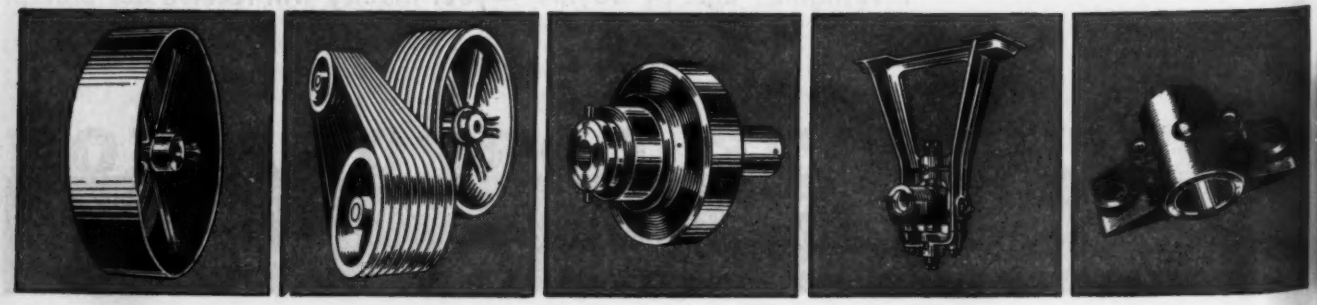
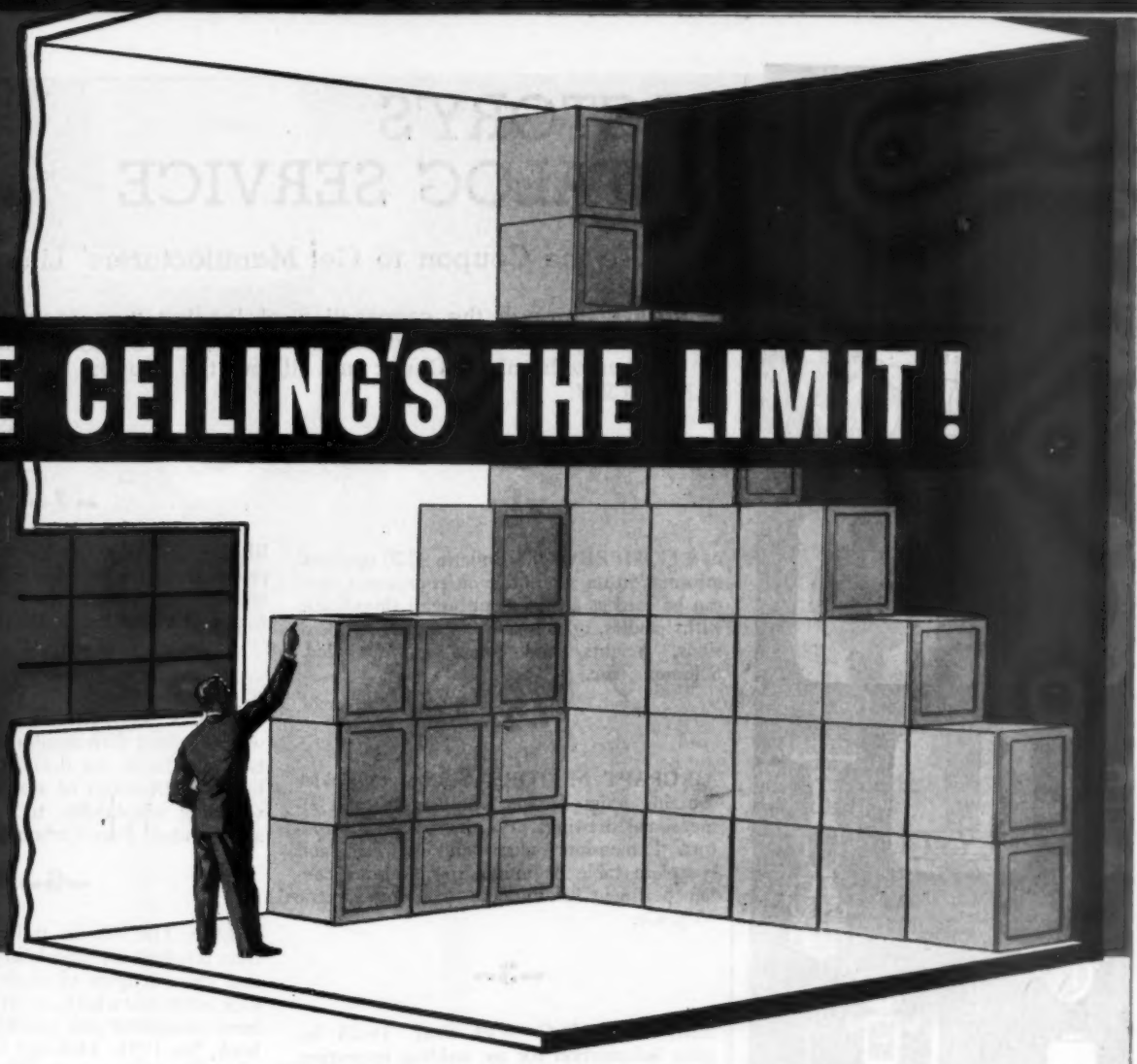


THE CEILING'S THE LIMIT!



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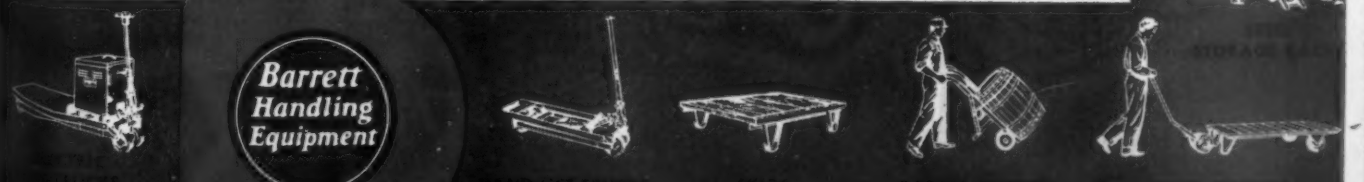

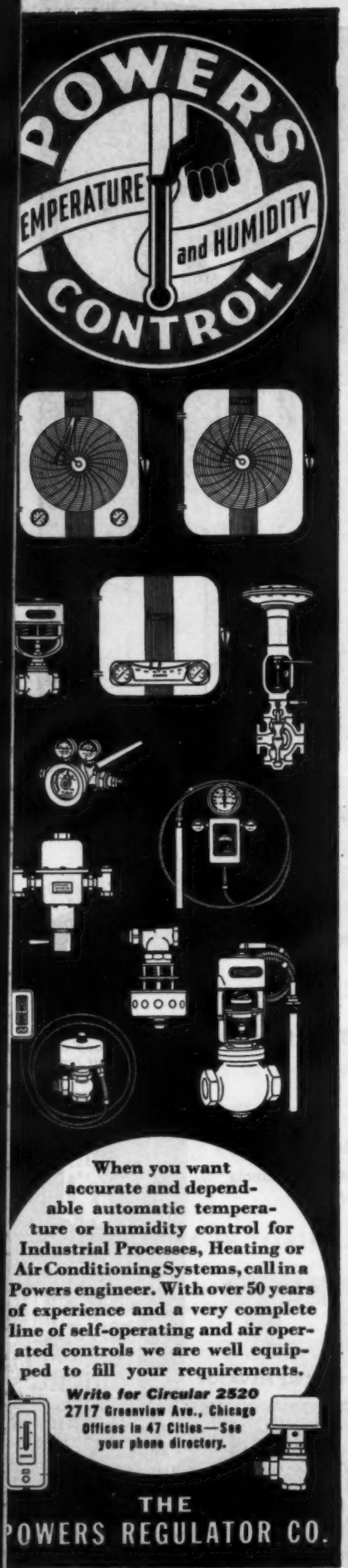
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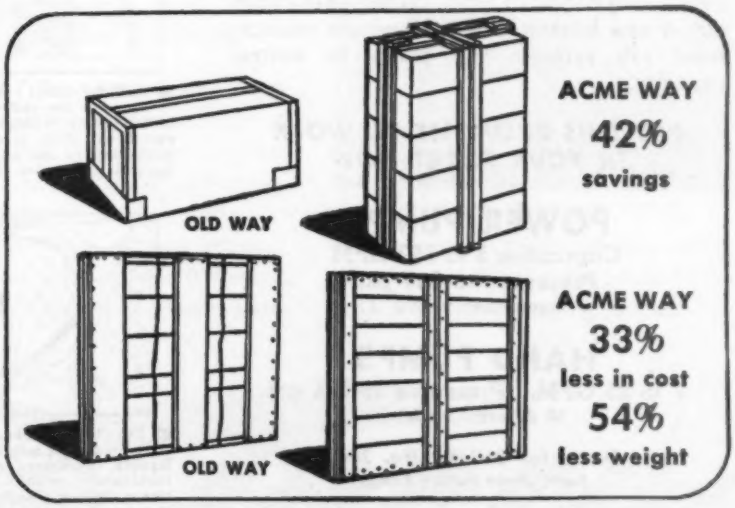

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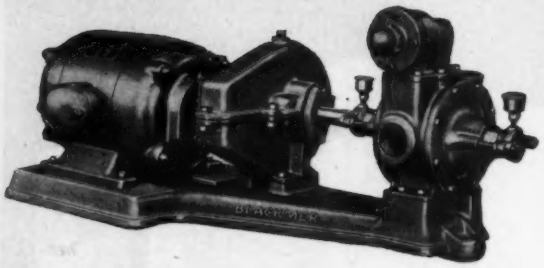

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Facts about Rotary Pumps

BLACKMER PUMP COMPANY,
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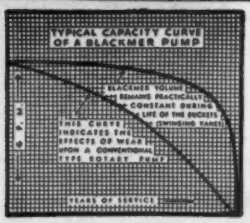
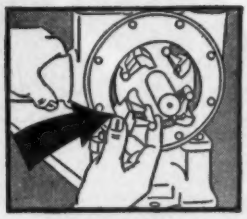
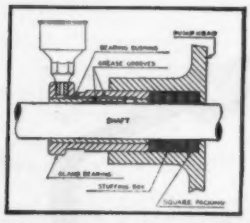


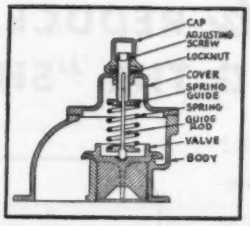
1 The curve shows the sustained capacity of Blackmer pumps. 20 years of service is not unusual. Compare this with a conventional type rotary.



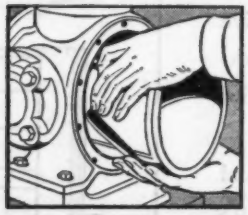
2 When the "buckets" (swinging vanes) finally wear out, this simple replacement restores the pump to normal capacity. It's a 20-minute job.



3 Double-bearings eliminate shaft-whip and provide exceptional rigidity. The bearings are located outside the pump casing, away from the pumpage, protected by packing.



4 Built-in relief valves will by-pass the entire capacity of the pump without shock or end-thrust. This gives positive protection to the pump. Valve operation is quiet—no chatter.



5 For tough jobs, handling corrosive or mildly abrasive liquids, Blackmer pumps are furnished with removable liners. When finally worn out the liner is replaced and the pump restored to normal capacity. This saves the cost of a new pump.

BLACKMER *Rotary* PUMPS
"BUCKET DESIGN"—SELF-ADJUSTING FOR WEAR

methods of drive selection, engineering data covering chain and sprocket construction, list of stock drives, and a section on installation are included. Morse Chain Co.

–8–

CLAMPS—Folder on a wire rope clamp features the fact that the two-part construction permits the inside to be forged and coined to fit the rope. Stock sizes and prices are given. National Production Co.

–9–

COFFEE SERVICE—Vacuum insulated coffee carriers are presented in folder stressing the morale-building influence of coffee served piping hot on the job. Both combination urns, in which coffee can be made, and less expensive urns for storage only, are available. Vacuum Can Co.

–10–

CONCRETE—A 4-page brochure gives the facts about a product that combines with cement, sand, and water to make a quick-setting floor. Greater compressive strength, and lower absorbtion are claimed for concrete made with this product. Stonhard Co.

–11–

CONNECTORS—A line of indent-type electrical connectors is presented in a 64-page illustrated catalog. Diagrams show construction features. One section is devoted to installation tools; another to Navy and commercial cable data. Burndy Engineering Co.

–12–

DRIVES—Seven different types of worm-gear speed reducers are illustrated and described in a 4-page folder. The full range of sizes and ratios available are given for each. The Cleveland Worm & Gear Co.

–13–

DRIVES AND HOISTS—Three bulletins present a line of hoists and machine tool drives. Data charts and price lists are included on loose-leaf pages. Some of the 500 available drives are pictured. The Master Electric Co.

–14–

DUST COLLECTOR—Features and construction specifications of industrial type "CK" unit dust collector, together with the capacities and dimensions of the three sizes available, are covered by 4-page bulletin No. 910. Pangborn Corp.

–15–

ELECTRONIC CONTROL—The fundamentals and applications of electronic control are described in a 12-page bulletin, GEA-4126. Fundamental principles of electronic

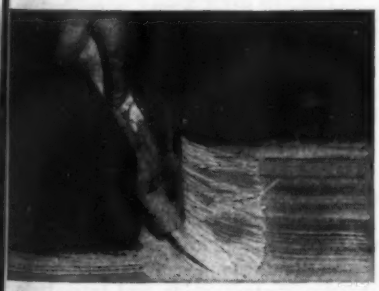
Paint and Dope Room *Clean-up* NO PROBLEM NOW!

Spraying, brushing or mopping with water quickly dissolves the Duramask. Paint, lacquer, dope, etc., float away.

Duramask is also impervious to glue, oil and other materials that usually make floor cleaning difficult.

Spatter and spillage are caught by Turco Duramask and simply hosed off with water

No more slow and costly scraping or scrubbing with dangerous solvents to clean paintroom floors! Water alone quickly flushes away every speck of paint, lacquer, fabric dope or other spillage on floors, walls and anything else protected by Turco Duramask.



Turco Duramask quickly applied by brush

This solution to the paintroom clean-up problem is a very simple, safe and inexpensive procedure. Duramask is easily applied with a large brush. It quickly dries to a white, light-reflecting surface that provides non-slip footing, is tough and long-wearing, and reduces fire hazard from sparks struck by dropped tools or shoe nails.

Although paint, lacquer, etc., can't penetrate Duramask and adhere to the surface underneath, water dissolves it. When mopped or hosed with water, therefore, the spillage it has caught is floated away with it.

Odorless and harmless to user and clothing, Duramask may be safely applied to anything that can be washed with water . . . walls, work benches, cabinets, wherever a dry protective film is needed. It's the sure cure for paintroom clean-up headache. Turco Duramask saves time, labor and money.

More Paint Recovered by Turco Deflocculator. For higher recovery of paint use Turco Deflocculator to treat the water curtain. It has a high buffer index and colloidal activity, works fast and efficiently. The oil and resinous vehicles of the paint are readily wet out and emulsified and the pigments thoroughly dispersed; hence they cannot make breaks in the curtain which sheets uniformly across the entire width. The recovered paint is not harmed.

A dry, dustless, non-segregating granular product with a pleasing odor, Turco Deflocculator is safe and non-irritating to handle and of long lasting effectiveness. Write today for more details of this money-saving product.

Deflocculator-treated water curtain

TURCO

SPECIALIZED INDUSTRIAL CHEMICAL COMPOUNDS

Turco

PRODUCTS, INC. Write Dept. FMM-3

MAIN OFFICE AND FACTORY: 6135 S. Central Ave., Los Angeles 1
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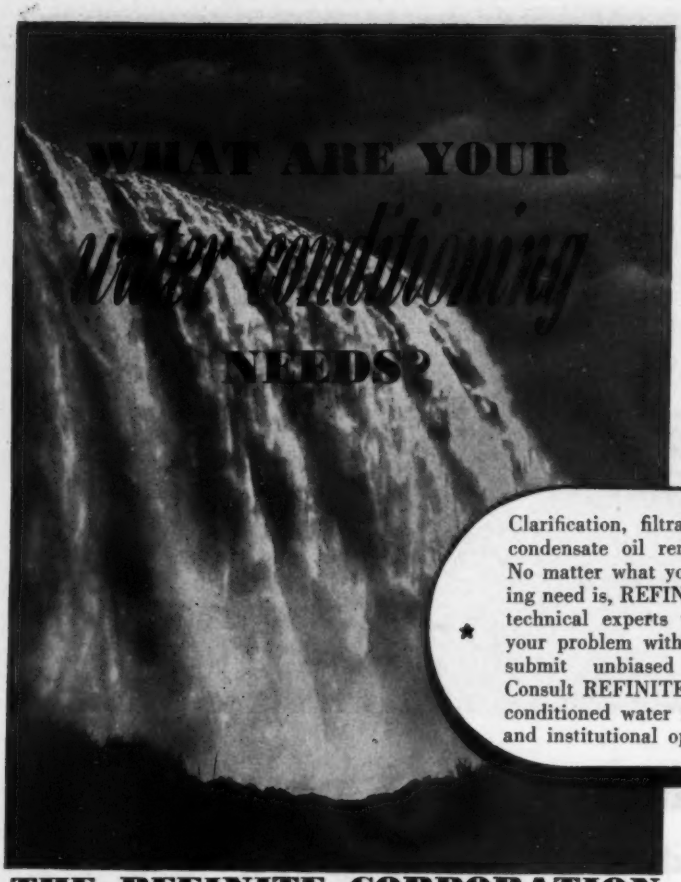


Clarification, filtration, iron removal, condensate oil removal, pH control? No matter what your water conditioning need is, REFINITE laboratory and technical experts will gladly analyze your problem without obligation, and submit unbiased recommendations. Consult REFINITE now . . . correctly conditioned water for every industrial and institutional operation.

THE REFINITE CORPORATION

Write for Free Catalog **101 Refinite Bldg., Omaha, Nebraska.**

Processing BASKETS

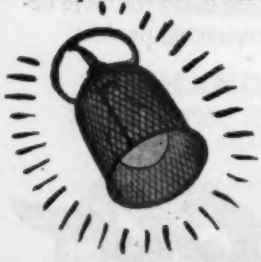
Built to Stand the Gaff — for Your Plant Production!

A COMPLETE LINE—heavy and light—or baskets specially-made for *your production needs!*

Large, or small . . . deep or shallow . . . with, or without handles . . . any size . . . are available to you!

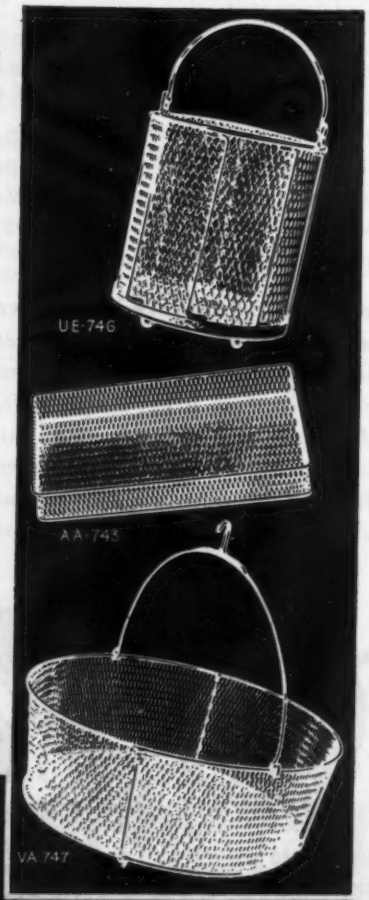
Made of perforated, or expanded metal, or woven wire, with heavy round rod frames. Either plain or stainless steel, monel or other metal. *All welded construction.*

Send for prices—special quotations on your requirements! Write us.



LAMP GUARDS

Electrically welded, durable, safe and economical, are available in sizes from 50 to 1000 watts. Order yours today.



HOFFMAN CO.
41-43 N. PENN STREET
YORK, PENNA.

tubes and their operation, and construction of the thyratron-tube, are explained. General Electric Co.

–16–

ELECTRONIC TUBES—A quick-selection chart of electronic tubes for industry is contained in a 4-page bulletin, ET-12. Technical data are presented in tabular form. Prices are included. General Electric Co.

–17–

FINISHING—is the subject of two folders. One contains finishing suggestions for wood and metal; the other treats sanding small or large surfaces of metal, wood, plastic, or composition. Photographs of operating methods supplement the text. Sundstrand Machine Tool Co.

–18–

FRAMING—A 20-page bulletin is devoted to a building set that includes framing sections, nuts, and fittings. The basic principle of the set, its 100 percent adjustability, is explained. Photographs of actual installations in industrial plants are shown. Unistrut Corp.

–19–

GAGES—and inspection instruments are photographed in color and described in a 16-page booklet. Plain cylindrical, straight-side spline thread ring, serration spline, and involute spline gages are included. Claimed accurate within millionths of an inch where necessary. Vinco Corp.

–20–

GLASS CLEANER—Two bulletins explain the properties of Saf-T-Klenz, a product perfected to dissolve light-obstructing film from greenhouse glass, now used in industrial plants and institutions. Berman Chemical Co.

–21–

HANDLING EQUIPMENT—A 6-page edition of an industrial handling equipment catalog supplements the first section distributed a year ago. The second section describes hoppers, trucks, platform skids, and truck trailers. Rose Mfg. Co.

–22–

HEATERS—Bulletin 509, 16 pages, deals with direct-fired heaters. Diagrams show nine basic designs and give B.t.u. capacities, dimensions, and specifications for 44 designs. Standard sizes range from 650,000 to 8,000,000 B.t.u. per hour capacity. Dravo Corp.

–23–

HEAT TREATING—A triple-control method of hardening is featured in 36-page Catalog T-621, on heat treatment of steel. According

Why the C-1 cargo ship doesn't need a convoy

C-1 is a plain name for a beautiful cargo vessel. Displacing 12,900 tons, it is capable of 40% greater speed than the EC-2 (Liberty). Its service record includes many instances of sailing without convoy, of evading and outrunning enemy submarines.

Construction of the C-1 necessarily calls for workmanship of a high order, an example of which—fitting drive shaft to propeller—is shown here.

Upright is the stern section of the shaft. When coupled with additional sections and installed in the ship, it measures double the length of a regulation bowling alley, weighs 52 tons and is dimensionally accurate to within 2/1000 of an inch.

This tolerance, however, isn't allowable in the joining of shaft and propeller. Several hours of meticulous fitting, scraping and refitting are required before the result is achieved—a solid "no tolerance" juncture able to withstand the strain and speed of turbine power.

Efficiency in the production of the C-1, of naval craft and ordnance, of other war products has won for the men and women of Consolidated Steel Corporation every basic government industrial award. We intend to keep up the good work. And when victory is won, this organization of skills and crafts will again help to build in steel the great plans of a peacetime America.

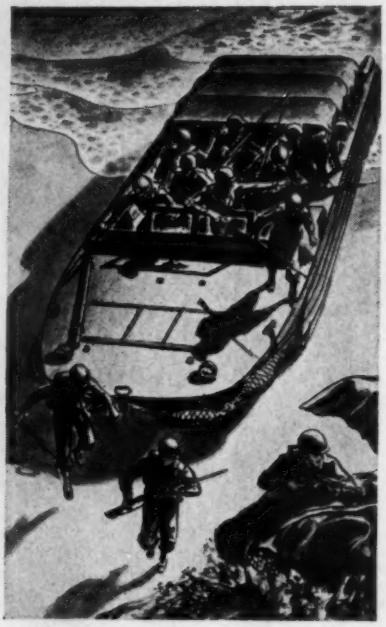
Consolidated Steel

FABRICATORS
ENGINEERS
CRAFTSMEN

LARGEST INDEPENDENT IN THE WEST

CONSOLIDATED STEEL CORPORATION, LTD., LOS ANGELES, LONG BEACH, WILMINGTON, CALIFORNIA; ORANGE, TEXAS

MULTIPLE UTILITY



MULTIPLE utility is one of the many outstanding features that makes General Electric ELECTRONIC MEASURING INSTRUMENTS practically pay for themselves in added service. Designed in the famous G-E electronics laboratories, this new line offers a wide choice of compact apparatus, for service, maintenance and research.

G-E unimeters, capacitometers, audio oscillators, wide band oscilloscopes, square wave generators, signal generators, power supply units—all give you dependable service in measuring electronic circuits and component parts.

While these sturdy, shock-resistant units are now in production chiefly for the Armed Forces, they may be purchased on a priority if you are engaged in war work. After victory, of course, the complete line will be available to everybody. . . . *General Electric, Schenectady, New York.*

• We invite your inquiry for G-E electronic measuring equipment made to meet your specific requirements.

FREE CATALOG

ELECTRONICS DEPARTMENT
GENERAL ELECTRIC CO.
Schenectady, N. Y.

Please send, without obligation to me, the General Electric Testing Instrument Catalog, F-8 (loose-leaf), for my information and files.

*Name*_____
*Company*_____
*Address*_____

GENERAL ELECTRIC
177-C3
Electronic Measuring Instruments

to booklet, this method guards the steel from abnormal stress, and reduces warpage and breakage. Leeds & Northrup Co.

–24–

HOSE REELS—that feature easy mounting, built-in valve construction, and easy turning, are described in Bulletin HR-43. Illustrations show the different types of mountings that are available. Schramm, Inc.

–25–

INTER-COMMUNICATION – A system that enables the executive to have all departments at his finger-tips is presented in Catalog 1944. The system described consists of one master station working with one to ten substations. The master station amplifier delivers an output of 2½ watts and operates on 110–115 volts a.c., d.c. Talk-A-Phone Mfg. Co.

–26–

JACKS—Catalog 202 contains a line of lifting jacks of all types and sizes, from simple push-and-pull jacks to air-motor-operated power jacks with capacities up to 100 tons. Specifications and industrial uses are outlined. The Duff-Norton Mfg. Co.

–27–

LATHES—Engineering and operating features of a 10x20-in. toolmaker's lathe are presented in a 32-page booklet. Each component part of the unit is photographed and discussed in detail. Extra equipment, turrets, and special applications are briefly treated. The Monarch Machine Tool Co.

–28–

LIFTS—Hydraulic-powered lifts are reviewed in a special issue of a trade publication. Stationary and portable airplane lifts and jacks, used to "flight position" planes are treated. Installations of platform lifts are illustrated and described. Globe Hoist Co.

–29–

LIGHTING—A fluorescent luminaire designed to give a high degree of lighting efficiency without harmful glare, at low cost, is the subject of Bulletin 43-H. Diagrams show design and construction. Martin Gibson Co.

–30–

LUBRICATION—A line of centralized systems to provide lubrication for any number of bearings is presented in an 8-page booklet. How the valves deliver oil or grease in measured quantities is explained with the aid of diagrams. The Farval Corporation.

–31–

MACHINING TOOLS—Operating information on a cast cobalt-base alloy, which was developed for faster machining of steel, is contained in an 8-page booklet. Drawings, photo-

REMOVES
GREASE and GRIME
Quickly and Safely
HO-ZOF
"HOSE IT OFF—DOWN THE DRAIN"

HO-ZOF, when used according to directions, turns accumulations of grease and oil into a soap-like fluid—which is easily "hosed" down the drain or removed by electric mopping machine.

HO-ZOF restores greasy metal, wood, glass, linoleum, brick, stone or cement surfaces. Ideal for removing unwanted grease from floor areas, shipping platforms, hand and machine tools, truck chassis, engines and parts, hotel kitchens, elevator pits, boiler rooms, etc.

SAFE. Non-inflammable. Non-explosive, no toxic fumes. Contains powerful disinfectant. Inexpensive. *Write Industrial Dept., R. M. Hollingshead Corp., Camden, N. J., for name of nearest distributor.*

Liquid and concentrated hand soaps • cleaners floor waxes, metal and furniture polishes • disinfectants • insecticides

Hollingshead
LEADER IN MAINTENANCE PRODUCTS

BUY WAR BONDS

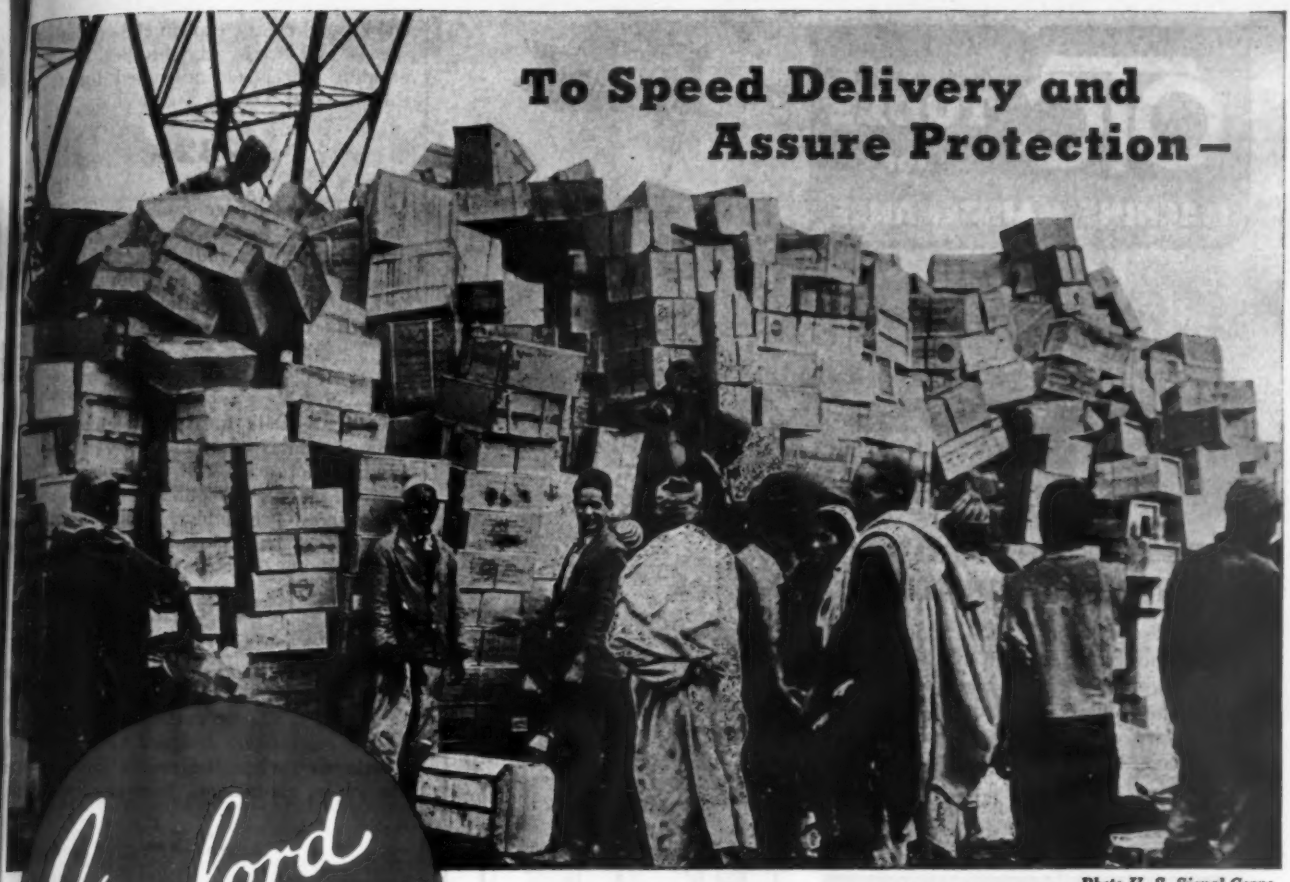
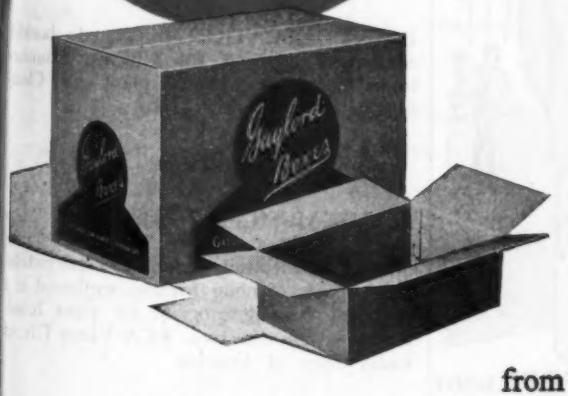


Photo U. S. Signal Corps

Gaylord Boxes



You can play a vital part — Buy More War Bonds!

Munitions and Supplies Go to War in GAYLORD CONTAINERS

Packaging problems of today's global war presented many new demands to Gaylord's packaging specialists. From the designing of special shock-proof cartons used in dropping munitions from airplanes to the production of food containers which withstand surf-borne landings and tropical moisture — Gaylord is playing a vital part in protecting and speeding delivery of war materiel.

GAYLORD CONTAINER CORPORATION, General Offices: SAINT LOUIS

CORRUGATED AND SOLID FIBRE BOXES
FOLDING CARTONS.. KRAFT GROCERY BAGS AND SACKS...KRAFT PAPER AND SPECIALTIES

New York • Chicago • San Francisco • Atlanta • New Orleans • Jersey City • Seattle • Indianapolis
Houston • Los Angeles • Oakland • Minneapolis • Dallas • Jacksonville • Columbus • Tampa
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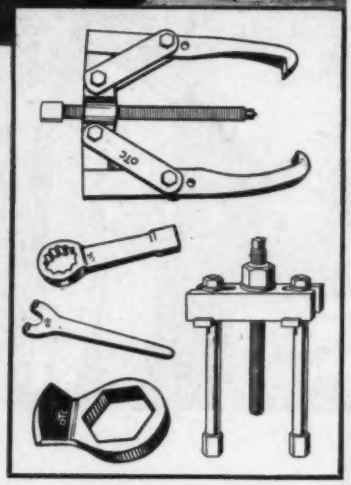
OTC TOOLS for MACHINE MAINTENANCE

TESTED and PROVED in WAR SERVICE

OTC Heavy Duty WRENCHES, PULLERS and SPECIAL TOOLS have performed every War job they were called upon to do—efficiently, quickly, safely. They are serving in the Army, Navy, Merchant Marine and War Plants.

OTC War experience is forging better machine maintenance tools for reconverted production after VICTORY!



OWATONNA TOOL COMPANY
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BIRD RUBBERLIKE MATTING SAVES

- YOUR MAINTENANCE COSTS
- YOUR FLOORS
- YOUR COUNTRY'S RUBBER

BIRD RUBBERLIKE*
is a composition product that is making industrial history.... Resilient, durable... it looks like rubber yet costs much less. Has dark finish. Heavy corrugations give it extra resiliency. Water doesn't make it slippery. Age does not rot it.... In heaviest service, RUBBERLIKE has proved its ability to withstand terrific punishment from foot and wheel traffic. Adds years of life to floors at cost of a few cents a year. RUBBERLIKE requires no installation; roll it up, lay it again; it lies perfectly flat, no curling. Made of non-priority materials. Order today from your supply house or mail coupon for free sample.

Three widths: 27", 36" and 54" *Also stair treads to match*

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Send free sample and name of nearest distributor of Bird RUBBERLIKE.

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graphs, and charts, explain the cutting angles, speeds and feeds, chip-breaker grinds, and grinding wheels recommended for use with this material. Haynes Stellite Co.

–32–

MOTORS—A 4-page brochure in color discusses motors for use wherever rotary oil hydraulic power is indicated. Blueprint-style diagrams show how the motor works; cross-section illustration shows how it is constructed. The Denison Engineering Co.

–33–

MOTORS—Data for synchronous motor selection, giving type of motor, method of connecting motor to load, starting conditions, starting, pull-in, and pull-out torques are contained in a 6-page folder. Applications include compressors, blowers, fans, mills, and pumps. Westinghouse Electric & Mfg. Co.

–34–

NOZZLES—Lubricating nozzles, and other specially built and standard nozzles are described in a 32-page catalog. Included is up-to-date information designed to help the spray nozzle user select the nozzle best suited to the job he wants done. Spraying Systems Co.

–35–

pH CONTROL—An 83-page combination handbook and catalog discusses control of pH, chlorine, phosphates in boiler water, and in water analysis. Methods for making colorimetric determinations, and applications of pH and chlorine control to 31 different fields are covered. W. A. Taylor & Co.

–36–

PLANT LOCATION—Illustrated booklet contains suggestions for Chicago manufacturers looking for a better plant site. Clearing Industrial District, Inc.

–37–

PLANT MUSIC—A booklet titled "Manpower, Music, and Morale" describes an industrial broadcasting system and pre-installation service. Among features explained is a proposed training program for plant broadcasting system directors. RCA Victor Div. of Radio Corp. of America.

–38–

PRECISION EQUIPMENT—for use in tool and machine industries, is found in Catalog 836. Items described are for use in layout, inspection, assembly, and general production. Illustrations and specifications are included. The Challenge Machinery Co.

–39–

PROCESSING EQUIPMENT—A 36-page booklet features thermal processing machines, from sub-zero to high temperatures. Their

LOOK to CLARAGE

FOR WAR AND POST-WAR AIR HANDLING AND CONDITIONING EQUIPMENT

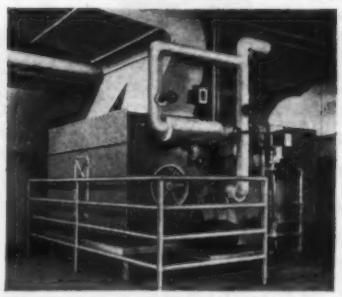
Today, as since Pearl Harbor, Clarage is playing an important part in meeting the enormous demands of industry, shipbuilding and government for air handling and conditioning units.

★ Tomorrow, after Victory, our long pre-war experience, plus notable research advancements born of war, will prove *exceedingly profitable* to those with peace-time requirements.

★ If you have an immediate and war-essential problem, look to Clarage NOW for units expertly designed and specifically built to your particular job — *and for prompt deliveries.*

★ Or, if you are thinking in terms of post-war service, look to Clarage NOW for any desired planning and cost-determining assistance.

★ Thus, when the time comes for action, your installation may be completed without delay and may incorporate the latest improvements in air handling or conditioning technique and equipment.



AIR CONDITIONING

Clarage builds both central station and unit air conditioners — suitable for complete conditioning, heating or cooling, humidifying or dehumidifying. The unit conditioners (floor and suspended types) can be easily installed without costly building alterations; used with or without duct work.

EXHAUST FANS

Clarage Exhaust Fans are made to cover all kinds of exhaust and blow pipe and pneumatic conveying requirements; used for dust collecting, removing fumes, and for conveying through pipes such materials as shavings, grains, etc. Fan Wheels statically and dynamically balanced. Famous Clarage dust-proof, oil-tight bearings standard equipment.

LARGE AREA HEATERS

Clarage Unitherm Unit Heaters are designed for service in factories, mills, etc. Equipped with centrifugal fans, they deliver heat at high velocity spreading it over wide areas. Both floor and suspended types available. Also Clarco (propeller fan) unit heaters for small factory areas, offices, stores—easily installed along walls or at ceiling.

IMMEDIATE HELP IN 45 CITIES

Each Clarage branch office is manned by experts — by Clarage engineers long experienced in satisfactorily meeting air handling and air conditioning requirements of every conceivable kind.

★ *Whether you have a war-time or post-war problem, you will find these application engineers eager to cooperate. You will like the intelligent way in which your inquiry is handled.*

★ Illustrated above are only a few of the units and systems built by Clarage. Write for catalog showing our complete line.

COMPLETE AIR CONDITIONING
•
COOLING
•
VENTILATION
•
FACTORY HEATING
•
MECHANICAL DRAFT
•
FANS and BLOWERS for INDUSTRIAL NEEDS

Clarage Fan Company Kalamazoo, Mich.

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

It's got something on the ball!

27 sizes with 4-hole head; 15, sizes with ratchet head. 8¾ to 29¾" high, 2 to 19½" lift, 5 to 30-tons capacity.

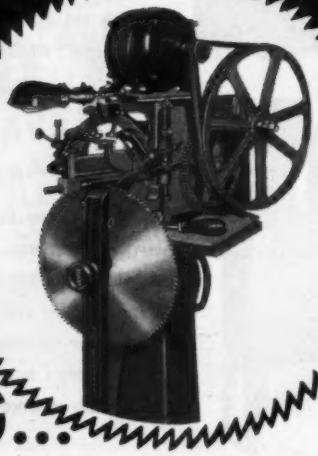
Self-leveling, drop forged cap "floats" on large chrome-molybdenum steel ball, reducing friction 88%. Safety peephole in unbreakable malleable iron base prevents over-extension of screw. Not just a screw jack—it's a Simplex Jack.

Templeton, Kenly & Company, Chicago

Better, Safer Jacks Since 1899

Simplex
LEVER · SCREW · HYDRAULIC
Jacks

Your **SAWS** are no better than your



SAW FILING...

Inaccurate saw filing can ruin the cutting efficiency of the best saws, perhaps crack or break them. The machine precision of Foley Saw Filing can increase your sawing output 25% to 40%. The Foley *automatically* joints the saw as it is filed, making all teeth uniform in size, height, spacing. Foley-filed saws run cooler, cut fast, do beautiful work—and stay sharp longer.

30-DAY TRIAL of the Foley Saw Filer is offered—to show you what a difference Foley-filed saws can make.

· FOLEY *Automatic* SAW FILER ·

FOLEY MFG. CO., 45 2nd Street N. E., Minneapolis 13, Minnesota

Please send literature on the Foley Automatic Saw Filer and details of your 30-Day Trial.

*Name*_____

*Address*_____

various applications, including rivet storage, instrument testing, and aging of metals, are listed. Data and illustrations given for each unit. Kold-Hold Co.

–40–

PUMPS—A line of coolant pumps is presented in a 60-page catalog, tab-indexed according to sections. Information given includes facsimiles of blueprint drawings, capacity in gallons per minute, motor current characteristics, and prices for entire line follow specification sheets in each section. Ruthman Machinery Co.

–41–

SAWS—"Setting up for any cut is as simple as 1-2-3" claims folder on a portable saw that custom cuts at any angle. Twelve cutting uses are illustrated. Details such as horsepower, current, rating, and cutoff capacity are given for different types of saws. DeWalt Products Corp.

–42–

SHEAVE—A 4-page bulletin, B6310, contains a sequence of six photographs to demonstrate the put-on, take-off operation for the "Magic-Grip" sheave. An accompanying sketch shows how the sheave is locked to the shaft to provide smooth-running performance, less overhang stress, and greater safety. Allis-Chalmers Mfg. Co.

–43–

SIFTER—A heavy-duty, low-head gyratory sifter for flour and cereal milling industries is described in Bulletin B-6124A. Included are perspective drawings of low-head sifter sieves. Questions pertaining to sifting problems are answered. Allis-Chalmers Mfg. Co.

–44–

SLIDE RULE—A simplified means for determining the correct size of air circuit breakers for industrial substation applications is offered in slide rule form. The rule has been constructed from standard AIEE formulas and takes into consideration motor load and d.c. component. Checks breakers on any system. Allis-Chalmers Mfg. Co.

–45–

SOCKET SCREWS—Catalog 41 describes design and manufacturing characteristics and industrial applications of various types of Holo-Krome "Fibro Forged" socket screws, and includes list price section and supplemental section of ASA standards. The Holo-Krome Screw Corp.

–46–

SPEED REDUCERS—Line of speed reduction units of single reduction type that can also obtain double reduction flexibility through integrally-mounted V-belt drive is illustrated

Air gets "muscles" when it moves

★

THE RIGHT FILTER IN THE RIGHT PLACE

Air-Maze Filters are constructed of crimped, wire screen cloth of graduated density. A large number of designs is available to meet different problems. We will be glad to recommend the filter best suited to your installation.

★

★ Quiet air can't hold much dust. But set air in motion and you give it "muscles". It picks up and carries lint, dust, gritty dirt and other impurities that otherwise would stay harmlessly "put".

Even without this added carrying capacity, each change of air naturally doubles the amount of dirt brought in, and creates a problem that may not even have existed before.

Wherever a blower or fan is installed, therefore, the possibility of a dust nuisance or danger should be forestalled by efficient, dependable air filtration.

Air-Maze permanent, cleanable panel filters offer both efficiency and economy. They are made in three basic types—for light service, for commercial installations and for industrial use—and in practically any size. Other types are available for removing grease, ink and other entrained substances from air.

We will gladly work with you to engineer a solution to your problem.

AIR-MAZE CORPORATION • ***Engineers and Manufacturers*** • **CLEVELAND 5, OHIO**

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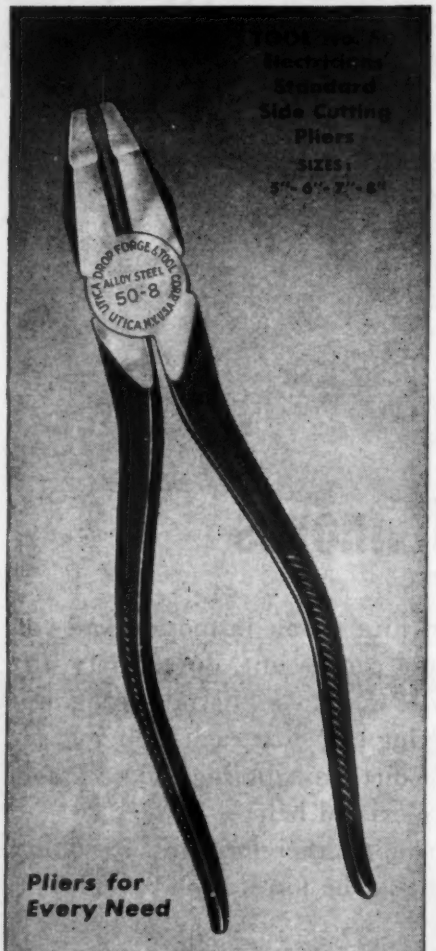
AIR-MAZE

SPECIALISTS IN AIR FILTRATION

UTICA
PLIERS
for More Tool Mileage



Pliers for Every Need

Time is saved by using UTICA Pliers and Adjustable Wrenches made to precision standards for hard usage. And UTICA, through its distributors, is doing its part in supplying working America with the best possible tools.

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UTICA
DROP FORGE & TOOL
CORPORATION
UTICA, N.Y.

with complete dimension tables in 12-page catalog containing latest information on the product. Stephens-Adamson Mfg. Co.

–47–

STEEL PRICES—A simplified price list contains data required to determine or check prices of steel purchased from warehouse stocks. Reference tables are provided for use wherever extras or deductions are applicable to the pricing of a commodity. Earle M. Jorgensen Co.

–48–

TAPPING AND THREADING — Greater precision, prolonged tap life, and flexibility are claimed for a line of tapping and threading machines discussed in a 4-page brochure. Additional information is given on a condensed specifications outline. The Warner & Swasey Co.

–49–

TESTING—"New World" is a 24-page, illustrated booklet, issued for the purpose of giving industry a brief, all-over answer to the question "What can science do for us?" Ten different fields are discussed specifically. United States Testing Co., Inc.

–50–

THREADING EQUIPMENT—A complete line of pipe and bolt threading machines, both portable and floor types, is covered in a 56-page booklet. Photographs of available equipment, descriptions of distinctive features, and specifications are given. The Oster Mfg. Co.

–51–

TOILET COMPARTMENTS—Nine types of toilet compartments are illustrated in 12-page Booklet 82, three of asbestos board, and six of steel. Specifications and drawings of construction details are given. The Sanymetal Products Co., Inc.

–52–

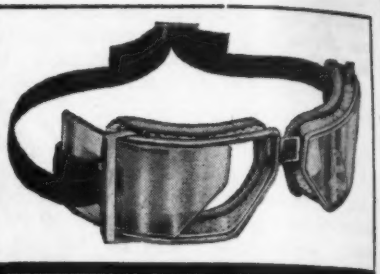
TRUCK—An 8-page folder discusses a fast platform shop truck called the "Chore Boy." Photographs show the truck in use at warehouses, industrial plants, and shipyards. Construction features, capacity, speed, and durability are explained. The Buda Co.

–53–

VALVES—A 6-page brochure describes line of air furnace, malleable iron, gate, globe, angle, and check valves. Valves are recommended for 150-lb. steam pressure at 450 deg. F., where severe service conditions are encountered. Jenkins Bros.

–54–

VALVES—An 11½x17-in. chart contains a breakdown of conditions to consider when selecting valves, and an explanation of what



THESE CESCO GOGGLES MEET RIGID REQUIREMENTS for Safety... Comfort... Durability

● Safety isn't enough in goggles. They've got to be comfortable too, else workers will leave them off when they shouldn't. After safety and comfort, they've got to have durability.

Examine CESCO's #220 Wide Vision Goggles, illustrated above. Safety engineers recommend them because CESCO lenses are crystal clear and hardened to resist severe impact. They give a wider range of unobstructed vision than any other goggles featuring a hardened glass safety lens. The binding seals perfectly to the face; the goggles rest comfortably because their light weight rests over a large area. Top and bottom ventilation eliminates fogging. An adjustable leather nose strap offers added comfort.

And, always remember, CESCO goggles are scientifically manufactured of highest grade materials.

HOW TO SELECT INDUSTRIAL HEAD AND EYE PROTECTION

Before you buy safety equipment, see CESCO'S new 48-page catalog. It's the standard for quality... write for your copy today.

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Your *future* **Diesel installation** can operate by air *through* **W·A·B** *controls*

One war development that can pay you big post-war dividends is in the field of engine controls, where W·A·B equipment is doing a remarkable job.

With W·A·B Controls, you can govern all functions of one or more Diesel engines from a central point. Speeds can be precisely established, and varied in small increments. Simple and positive interlocks make it impossible to damage equipment by accidental changes in sequence of control operations. Synchronization or load balancing of engines in parallel is simple and easy. And control may be readily extended to related functions of the driven machines.

When you are thinking about improving your production methods—or improving any product where an operator is involved—it will pay you to consider the contribution that W·A·B Controls can make, and to give them a place in your planning.

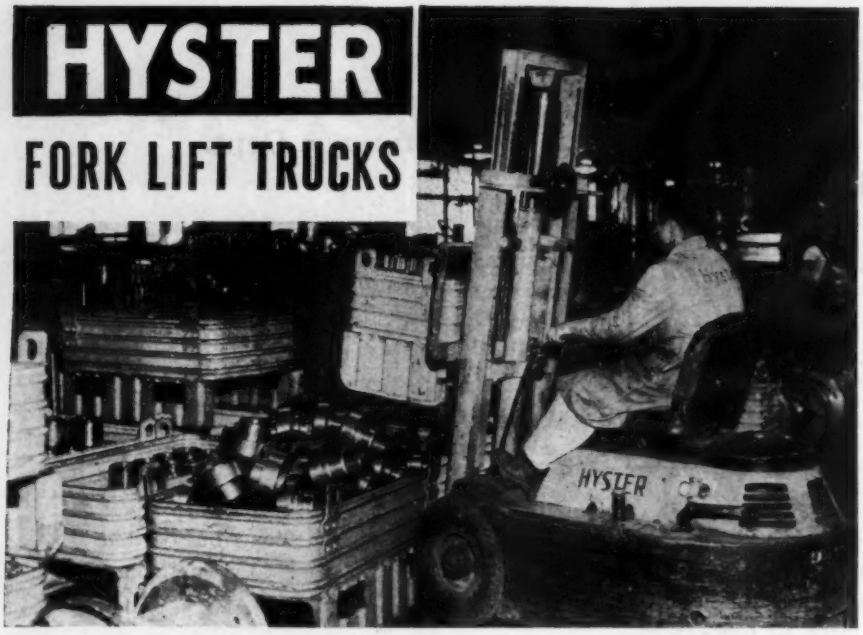
Westinghouse Air Brake Company
INDUSTRIAL DIVISION
General Offices: Wilmerding, Pa.
75 Years of Pneumatic Control Experience

W·A·B

Pneumatic . . . Pneumatic-Electric . . . Pneumatic-Hydraulic

control systems

HYSTER
FORK LIFT TRUCKS



In the crowded isles of work-congested factories the compactness and maneuverability of the HYSTER 20 Lift Truck solves the problem of moving parts in process through the plant. And on pneumatic tires it goes places and does things impossible for other trucks.

For detailed information send for catalog 673.

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WILLAMETTE
HYSTER
COMPANY

BROWNHOIST BUCKETS

The greedy jaws of Brownhoist clamshell buckets speed up material handling in dirt, clay, coal, gravel and ore. Their deep, clean bites practically eliminate hand shoveling. Extra sturdy. Large sheaves reduce rope wear to a minimum. AVAILABLE IN ROPE-REEVE, POWER-WHEEL AND LINK-TYPE. For facts and prices write to Industrial Brownhoist Corporation, Bay City, Michigan. Offices in New York City, Philadelphia, Pittsburgh, Cleveland and Chicago.

these conditions determine in the operation of a valve. Available on heavy cardboard for tacking up. Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc.

–55–

VALVES—Catalog 14-B, 36-pages, describes line of butterfly valves. It illustrates both manual and power-operated valves for pressures from 15 to 900 psi. Contains detailed specifications, applications, and descriptions. R-S Products Corp.

–56–

VALVES—for marine and industrial use, trademarked Kerotest, are illustrated with detailed specifications of each series type and size in 32-page cloth-bound Catalog 43-M. Manufacturing and laboratory facilities are described, and information is included on alloy specifications and engineering standards met by the product. Kerotest Mfg. Co.

–57–

VENTILATORS—A 24-page illustrated booklet presents a type of ventilator that utilizes all outside air currents, although it is stationary. Construction details, principles of operation, dimensions, and performance data for various units are given. G. C. Breidert Co.

–58–

WELDING—Making repairs on iron castings by electric arc welding is discussed in a 12-page illustrated booklet. Four types of electrodes for use on cast iron are described, and the characteristics and best welding procedures are explained. C. E. Phillips & Co.

–59–

WELDING CRANES—A 2-page illustrated bulletin, Unit 68, describes a design of automatic welding cranes that was developed to facilitate the handling of large welding jobs. Topics covered include application, motors, controls, and specifications. Whiting Corp.

–60–

WIRE CLOTH—is treated in three bulletins; No. 603 offers information and tables on how to select and specify all types of industrial wire cloth; No. 601 covers an abrasive resistent wire cloth; No. 602 outlines methods of specifying both square and long diamond mesh, as well as many types of installations. Buffalo Wire Works Co., Inc.

–61–

WIRE MESH—A pocket-sized booklet, 96 pages, explains ordering procedure facilitating shipments, explanations of different types of weaves in wire cloth, metals and alloys available, laboratory and research facilities. Tabular material lists complete data on sizes, gages, and weights. C. O. Jelliff Mfg. Corp.

SPEED PRODUCTION WITH Gilmer BELTS

Gilmer makes complete line of V-Belts, Endless or Non-endless Flat Belts, and a full range of highly specialized belts for use wherever standard belts are unsuited. For further information about the various Gilmer Belts and their plant applications, write for a FREE copy of the Gilmer Belt Catalogue.

GILMER V-BELTS: Space-saving, silent, shock-absorbing belts, built to lock in the grooves with a non-slip grip. Made in standard and special sizes.

GILMER KABLE KORD BELTS: Rubber fabric and tough continuous cord construction give you a contactor and power belt in one. Exceptional grip and strength combine in these flat belts with low stretch, small slippage and extra tensile strength.

GILMER ENDLESS PLANER BELTS: A typical special purpose belt of endless cord construction for planer and gang-saw drives.

GILMER HEVALOID ENDLESS BELTS: Made under the Hevaloid patent with Neoprene compound that provides high coefficient of friction. For precision work at top speed of 9000 f.p.m. Resists oil, heat, stretch and slippage.

GILMER SPEEDAGE BELTS: Very light, lapless, flat, fabric belts for high speeds to 10,000 f.p.m. and over. Assures chatterfree production.

GILMER RHO ENDLESS BELTS: Flat endless belts, oil-resistant, jacket-enclosed. Sturdy, light and very flexible, for speeds under 7400 f.p.m.

The Gilmer Engineering Staff has planned a National Power-Recovery Plan . . . a FREE wartime service to Industry . . . approved by the WPB . . . to save power in the following services: Steam, Gas, Water, Electricity, Mechanical Transmission, Boilers, Compressed Air, Refrigeration and Prime Movers. Write for your FREE copy today.

Gilmer BELTS

USE WHAT YOU LOSE

L. H. GILMER COMPANY, Tacony, Philadelphia 35, Pa.

The Oldest Firm of Rubber Fabric Belt Specialists

SWIFT · · TIME-SAVING MECHANIZED HANDLING

Move large quantities or units of steel with a minimum of relays or stops · · · · ·

★ To save time—to increase safety—to cut costs — to save rehandling — to conserve manpower AUTOMATIC FORK LIFT TRUCKS offer an immediate answer They are proving their ability and flexibility in this regard daily, aiding materially in giving users a controlled system of handling.

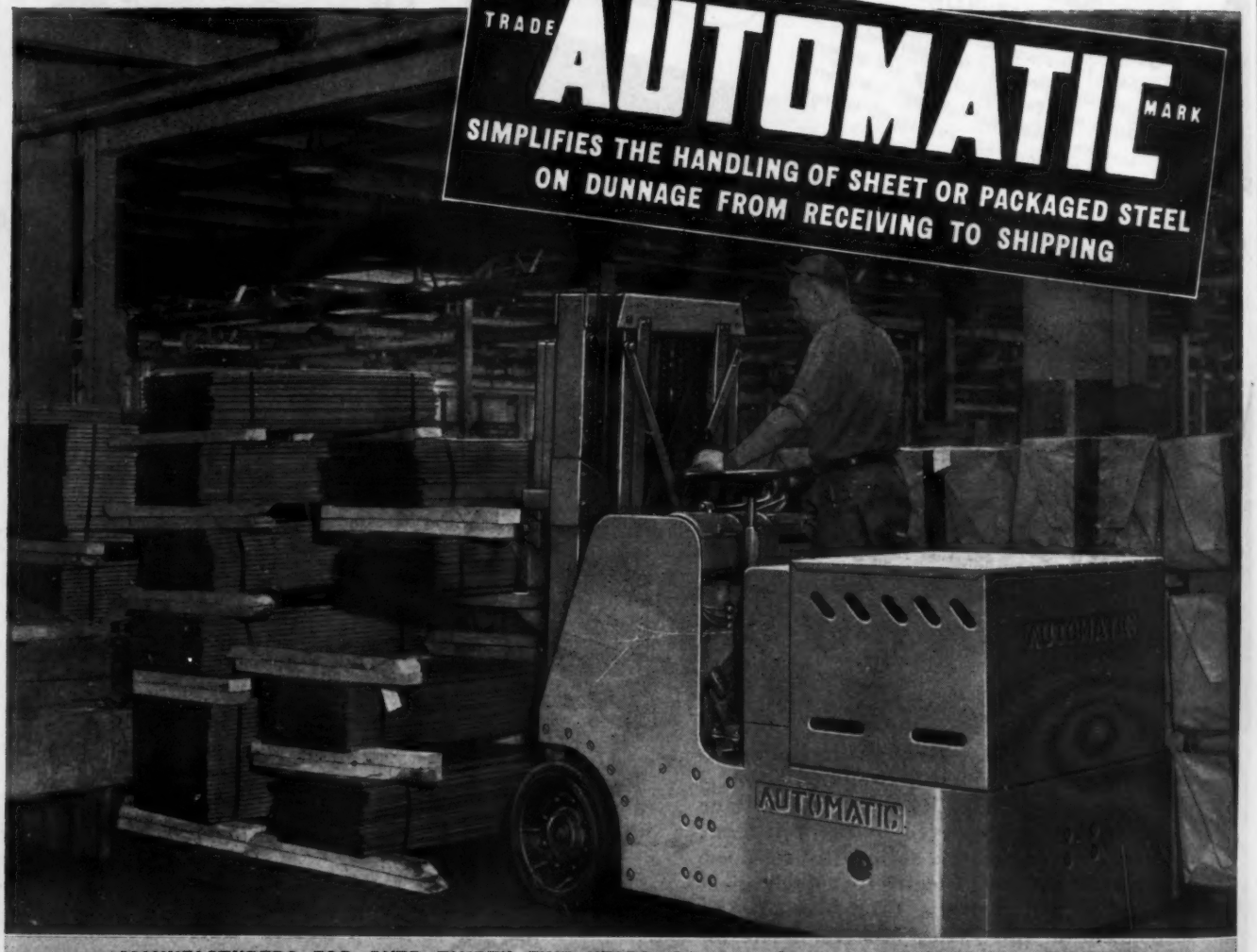
Bundles of sheet steel or packaged units, when being placed in storage, can be easily piled upon each other in tiers. Not only is floor space saved but the packages are in convenient arrangement for quick and easy movement from storage. The exceptional maneuverability of "AUTOMATICS" becomes of great value in congested areas. Easy to operate—one trucker handles tons daily without fatigue.

●

Investigate "AUTOMATICS" today. "AUTOMATIC" representatives are listed in the classified telephone directory in principal cities and industrial areas under "TRUCKS" INDUSTRIAL.

TRADE **AUTOMATIC** MARK

SIMPLIFIES THE HANDLING OF SHEET OR PACKAGED STEEL ON DUNNAGE FROM RECEIVING TO SHIPPING

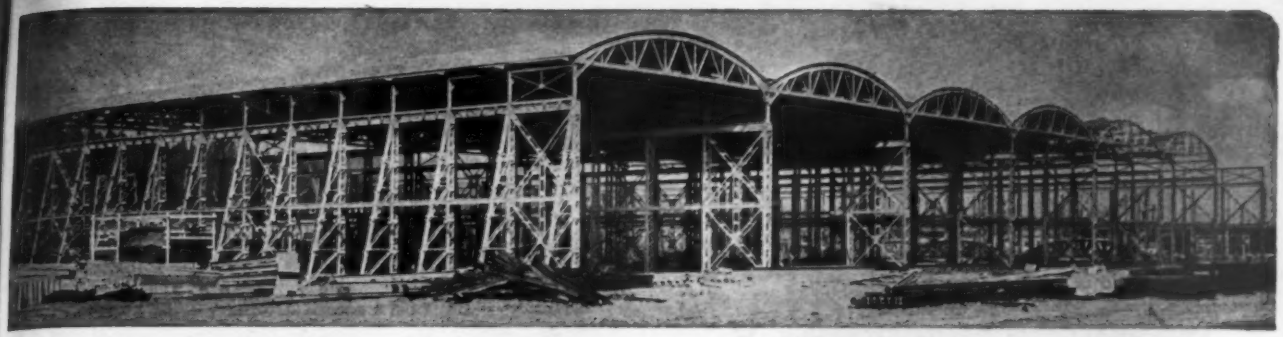


MANUFACTURERS FOR OVER THIRTY FIVE YEARS *Electric Propelled* INDUSTRIAL TRUCKS

AUTOMATIC TRANSPORTATION CO.

DIV. OF THE YALE & TOWNE MFG. CO.

39 WEST 87th STREET CHICAGO 20, ILLINOIS



THE MARITIME COMMISSION found wood a highly satisfactory construction material in its shipyard program. This huge assembly building at a record-breaking Liberty yard is 240'x860' and contains 143 trusses prefabricated and erected by Timber Structures, Inc.

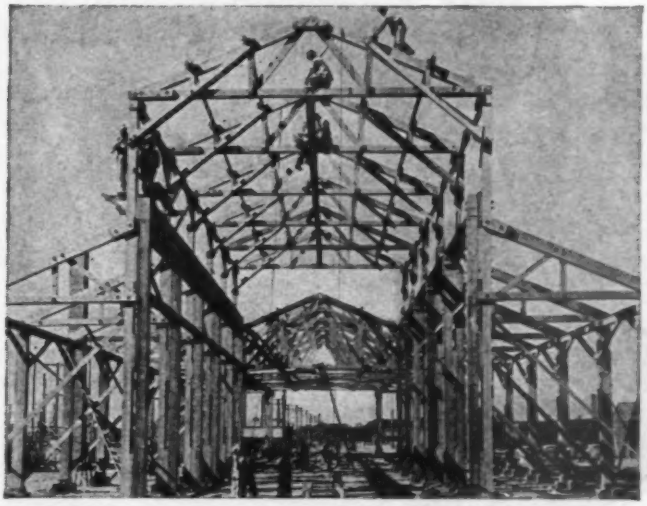
MATERIALS ARE IMPORTANT-

...BUILD WITH TIMBER STRUCTURES

THE WAR has spotlighted the virtues of wood in heavy construction. Shortages in other structural materials have served to emphasize what many engineers and architects already know—that wood, properly designed and prefabricated, is often a sensible answer to construction requirements.

Fulfilling these requirements for timber trusses and heavy framing has been Timber Structures job for years. The virtues of wood—strength, economy, speed in erection, permanence, ready source of supply—have been brought together through the engineering know-how of this organization.

We welcome inquiries on the use of wood or other structural materials for your construction projects. Write to the nearest Timber Structures office for illustrated book on the work we have done, are doing.



ORIGINALLY DESIGNED FOR STEEL by the U.S. Army Engineers, this ordnance repair shop was redesigned by Timber Structures engineers for wood. For this building (60'x220') 28 trusses, columns and bracing were prefabricated and erected. Approximately 50,000 bd. ft. of lumber was used in the building.

MORE THAN 2000 TONS OF STEEL WERE SAVED when Timber Structures supplied trusses and heavy framing for this navy blimp dock. 72% of the Navy's timber requirements for its comprehensive L.T.A. hangar program was entrusted to this organization, involving more than 30 million board feet of fireproofed timber.

TIMBER STRUCTURES
WARD MAYER
INCORPORATED
Portland 8, Oregon — New York 17, N.Y.
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Engineering in Wood

MAIL COUPON FOR LITERATURE

TIMBER STRUCTURES, Inc.
Send Book "Engineering in Wood"

Name_____

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If *west* of the Mississippi, send to Portland 8, Oregon. If *east* of the Mississippi, send to 535 Fifth Avenue, New York 17, N. Y.

Use new Buying Data

TO REDUCE SELECTION AND ORDERING TIME

1/2

simplified

FOR QUICKER SELECTION . . .

EASIER ORDERING . . .

QUICKER DELIVERY . . .

When you need motors and control, consult your new Westinghouse Buying Data. It will help you to select and purchase the proper equipment—in ½ *the time.*

Data, as presented, is striking in its newness. It's easier to read, easier to understand, and easier to use than any offered previously by any manufacturer.

To fit widely varying requirements, this radically new Buying Data is available in two forms:

Motor and Control Loose-Leaf Book. This is for the use of large-scale purchasers and is "tailored" to meet the needs of the individual buyer. Pricing data is always kept up to date by the issuance of new price supplements.

Bound books are suitable for use of the majority of motor and control buyers. They contain prices (correct at time of issue and satisfactory for estimating purposes throughout the books' life), dimensions, application data and descriptions. Books include:

"Motor Buying Data" covering popular types and ratings of motors (up to 100 hp), Gearmotors and M-G sets.

"Control Buying Data" listing a wide variety of controllers and accessories for direct current, single-phase, squirrel-cage, wound rotor motors.

J-90499

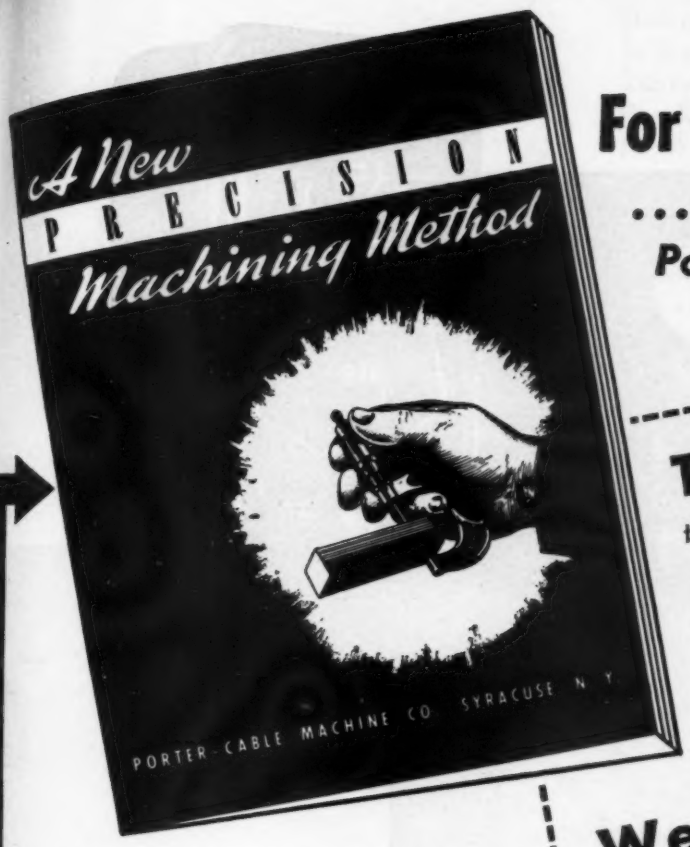
HERE'S HOW TO GET THIS NEW BUYING DATA

If you are a buyer of Motors and Control, chances are you have already received this new data by mail.

However, if you have not received your copy, write, wire or phone your nearest Westinghouse district office (requests will be filled through district offices only—no mailings from Westinghouse Headquarters at East Pittsburgh). Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Westinghouse MOTORS AND CONTROL

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE



For Cost-Minded Managers

...who are keeping an eye on Postwar Production Problems:

This FREE Book

that explains the remarkable savings of

PORTER-CABLE'S

New and Improved

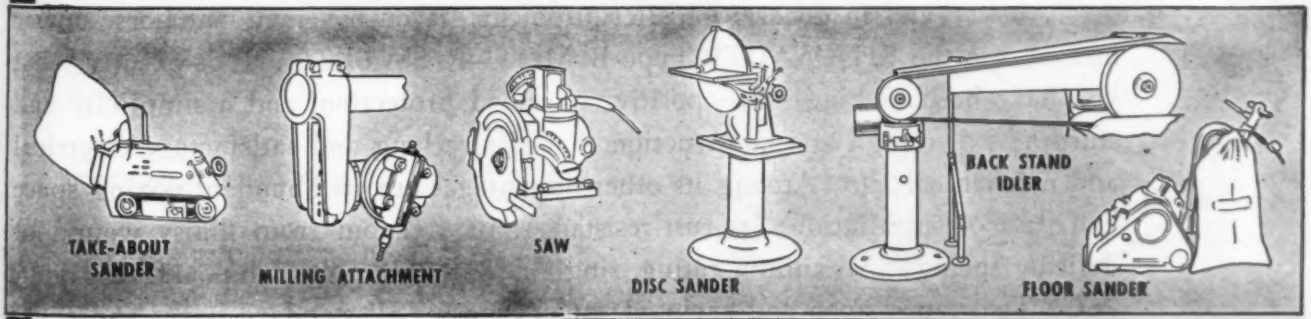
Wet-Belt Surfacing

With Wet-Belt Surfacing You Can:

- machine 5 to 25 times faster
- hold close limits, often to .0005"
- work an entire area at once
- produce final finish while taking cuts
- reduce the use of fixtures
- reduce set-up and lock-up time
- avoid warping, cracking, discoloration
- reduce dust or grit, hazardous to health and precision equipment

Production at a competitive cost! That's going to be one of the first problems that management must face after the war. And that's why forward-looking executives everywhere are looking with favor on the installation of Porter-Cable Wet-Belt Surfacers. These high-precision abrasive belt machines not only speed today's production by doing operations formerly assigned to millers, grinders, planers, shapers, lathes—not only simplify today's labor training problems—but they actually turn out work faster and AT LOWER COST than the larger, more expensive machine tools can equal.

For Both Production and Maintenance P-C Machines Are Big Money Savers!



Get a Copy of THIS BOOK Today

for Yourself and Your Production Men

Just write a letter on your company letterhead, telling us how many copies you want for your key executives. Please indicate your title.

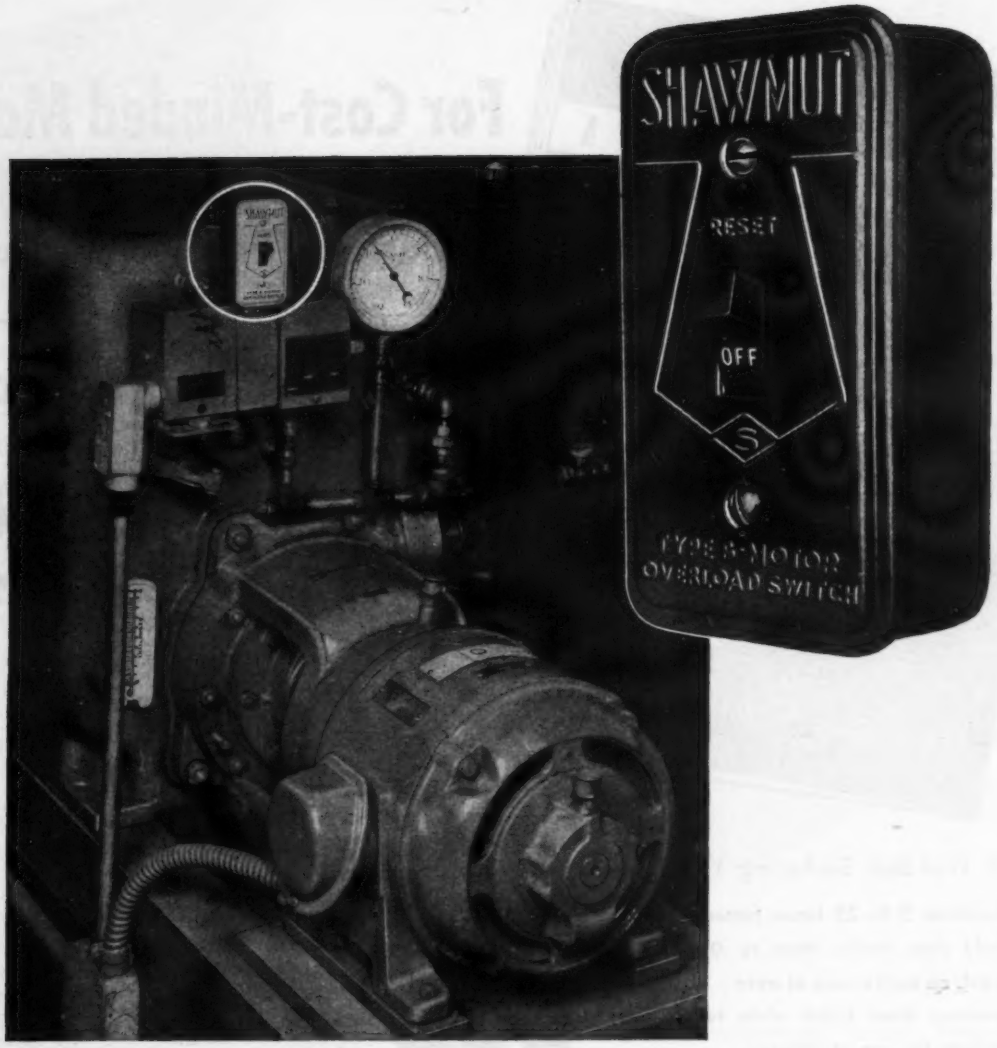
PORTER-CABLE MACHINE CO.
2150-3 N. Salina Street, Syracuse 8, N. Y.

Please send me a copy of "A New Precision Machining Method."

Name .....

Company ..... **Title** .....

Address .....



ON SMALL PUMPS

and in general on all equipment driven by fractional horse-power motors, use the SHAWMUT Type-B MOTOR SWITCH. It is exactly what you have been looking for — positive overload protection, and a simplicity and sturdiness of design and construction that ensure long and satisfactory electrical and mechanical life. Among its other advantages are its abundant wiring space and ease of installation; its rust-resistance; its freedom from flimsy wound or delicate springs. Maximum rating, single and double pole, 1 h.p., 115-230 volts A.C. Two types, open and enclosed; open type fits all standard boxes and cover plates. Exclusive patented features, other patents pending. For full information, ask for our Bulletin 406.

THE CHASE-SHAWMUT COMPANY
NEWBURYPORT, MASSACHUSETTS

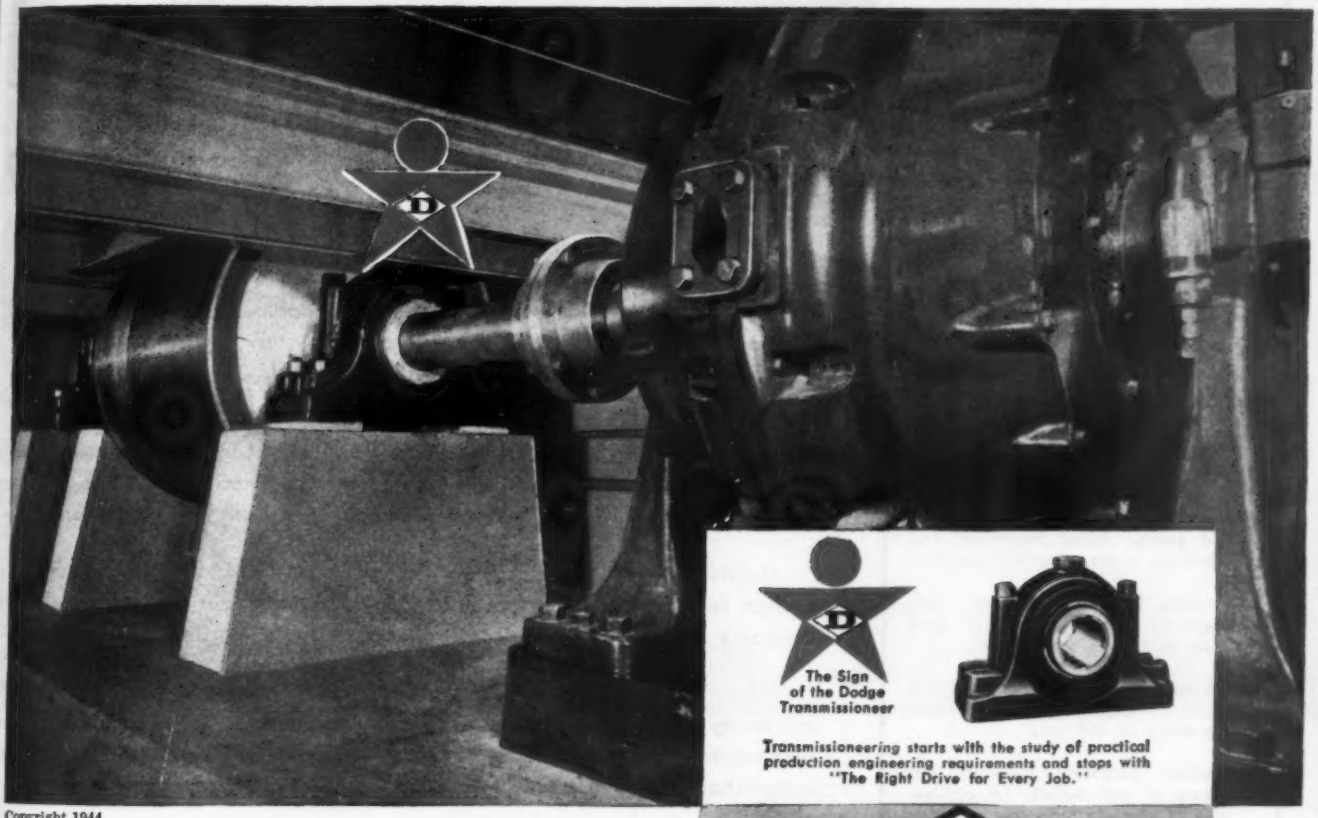
Transmissioneering Delivers More Power through Bearings

Dodge Transmissioneering offers you long experience in proper application, use and maintenance of Dodge-Timken Bearings and other Dodge Power Transmission Equipment. Bearings are the backbone of your power transmission . . . they are the "power stations" that feed your production machines. Super-ruggedness and precision in Dodge-Timken Bearings guard against power waste and production letdowns.

Since you pay the same for power, dissipated or delivered, make sure of maximum power-delivery, for present or postwar production, by installing Dodge-Timkens at every point of friction or hard service.

For sound Transmissioneering service, contact the nearest Dodge Transmissioneer, or write . . .

DODGE MANUFACTURING CORPORATION
Mishawaka, Indiana, U. S. A.



The Sign of the Dodge Transmissioneer

Transmissioneering starts with the study of practical production engineering requirements and stops with "The Right Drive for Every Job."

Copyright 1944
Dodge Manufacturing Corporation

Advantages of
DODGE-TIMKEN SPECIAL DUTY BEARINGS

1—Full ball and socket self-alignment ...guards against power waste and wear.

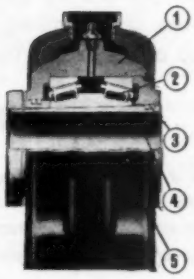
2—Timken tapered roller bearings give full radial and thrust load capacity . . . put full power in production.

3—Easy to install—simply slip over shaft and tighten collar.

4—Piston ring seals retain lubricant and exclude dirt.

5—Rugged outer housing gives overall protection to bearing.

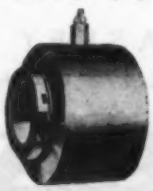
Furnished completely assembled . . . ready for instant installation . . . capable of 30,000 hours of service . . . pre-lubricated for 50-million revolutions under normal conditions without relubrication . . . sealed against admission of dirt or leakage of lubricant. They eliminate maintenance delays . . . conserve vital man-hours and critical materials . . . speed peak production.



DODGE

THE RIGHT DRIVE FOR EVERY JOB

"D" Unit Mount



"S-1" Unit Mount

"B-1" Unit Mount

BUY MORE WAR BONDS

What McCASKEY Control will do for you . .

Experiences in hundreds of plants, large and small, employing from a few to many thousands, prove that McCaskey Tool Crib Control . . .

1 Reduces crib inventories

2 Eliminates loss and theft of tools

3 Reduces breakage to an absolute minimum

4 Quickly locates all tools whether in the crib or in possession of workmen

5 Speeds crib service, reducing non-productive waiting time of workers and machines

6 Reduces tool clearance time of departing employees to a fraction of a minute

7 Definitely records employees' responsibility for tools, preventing disputes when tools are returned or workers quit

8 Is operated with minimum crib personnel; inexperienced attendants of either sex trained in about one shift

9 Is easily installed in busiest cribs and plants; initial investment and operating expense quickly repaid.

10 Provides for inspection and, when necessary, reconditioning of used tools before replaced in bins

11 Shows how long workmen retain tools; prevents keeping more than necessary at any time

12 Provides perpetual inventory and record of tool activity for elimination of obsolete tools and reduction of excessive inventories

13 Gives you facts justifying or denying necessity for tool purchases

14 Provides reliable data on life and comparative performance of brands and types of tools

15 Gives you accurate basis for allocation of tool expense to various departments

Why Install Tool Crib Control Now?

Engineers and operating men continue to drive themselves at top speed to get out production on essential jobs. Dependable subordinates are scarce. Why add the job of installing a new tool crib system now?

There are fifteen reasons in the column at the left. Consider only two.

Tools have been scarce, as everyone knows, even for war production. As a direct result, however, most tool inventories are unbalanced. Pressure has brought over-stocks of many items, although others still are dangerously low.

McCaskey Tool Control provides a simple means of determining actual production requirements. It will enable you to reduce your tool inventory with assurance that you know the exact number of each kind and size you need.

When you resume peace-time production you will not face the necessity of sacrificing excessive inventories of tools you cannot use. A Massachusetts plant that recently adopted McCaskey Control reduced tool purchases to such an extent that sources of supply were sure their contracts had been cut back.

Installations are being made by girls without previous factory experience aided by the suggestions of McCaskey industrial specialists. The job can be done now in your most active cribs. You will save now and later too.

●

Let us have a representative explain how McCaskey Tool Control can be installed in the busiest cribs without disturbing production in the least — or send you factual reports on McCaskey savings in time and tools in several well-known plants.

THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCaskey Systems Ltd., Galt, Ontario, Canada — *The McCaskey Register Co., Watford, England*

McCASKEY INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • MAINTENANCE • TOOLS • COSTS • PAYROLL

"UNIVAN"

That Tough Steel

Tougher than a Century of Storms

Ancient and battle-scarred, this defiant old tree still stands up against nature's worst. That takes *toughness*—the kind of toughness and long life you'll find in "UNIVAN". Castings made from this Alloy steel scientifically heat-treated have proven in countless applications that they can absorb heavy shock and severe stresses with notable lack of fatigue. Where the going is tough specify "UNIVAN"—that tough steel. Make use, too, of Union's long experience in fabricasting intricate designs.

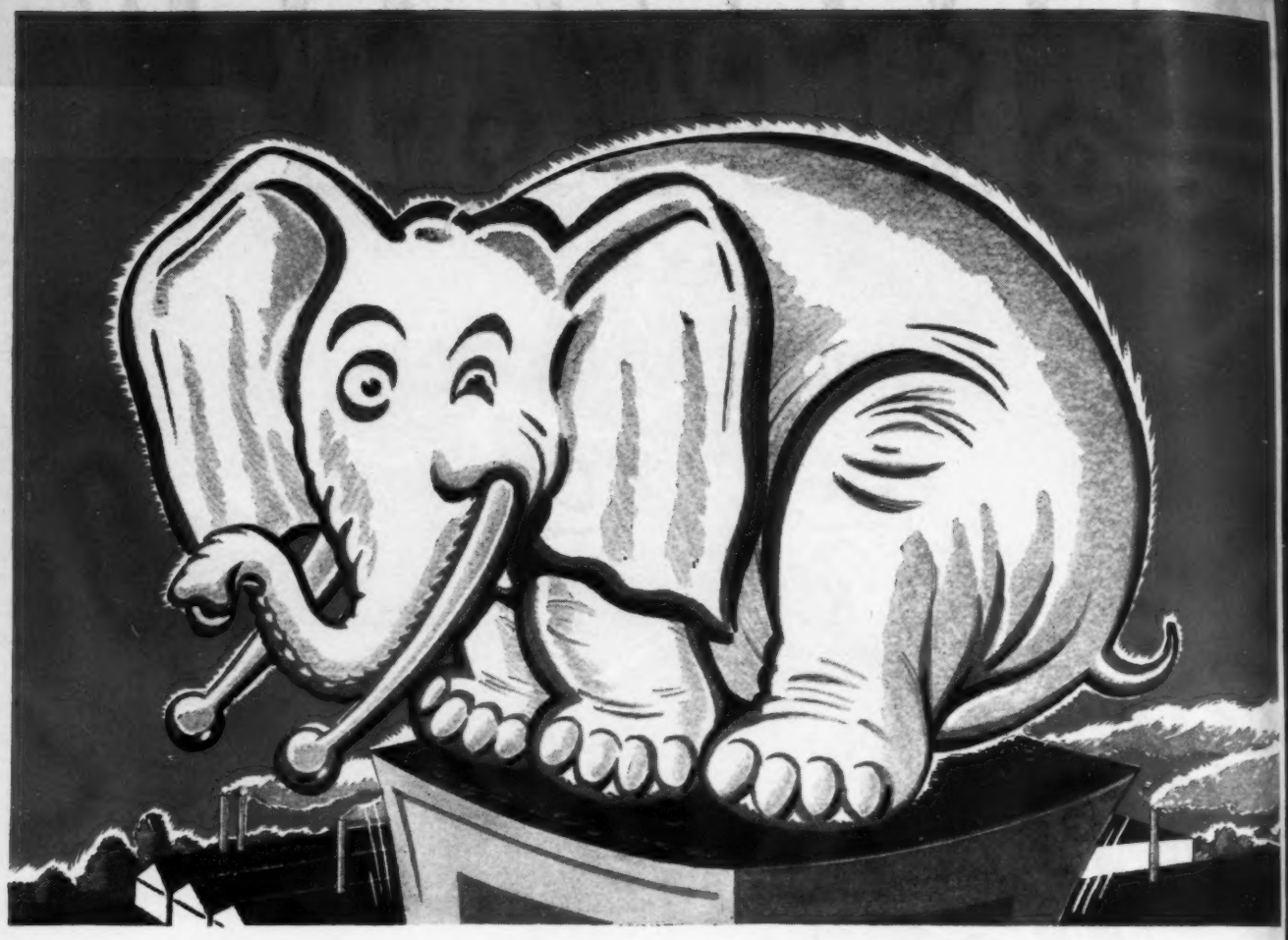
ARMY E NAVY

For Long Life with Economy
Specify "UNIVAN"—*that Tough Steel*

UNION STEEL CASTINGS

DIVISION OF
BLAW-KNOX CO.
PITTSBURGH, PA.

MAKERS OF Driving Wheel Centers, Locomotive Frames, Pump Casings, Vault Doors and Frames, Annealing Boxes, Spindles, Coupling Boxes, Open Hearth Charging Boxes, Gear Blanks — and other Castings for Steel Mills and General Industry.



The problem of keeping White Elephants off the roof

. . . when seeking High Temperature Relief . . . Solved by Allen Engineers

In high-temperature relief situations, where tremendous quantities of heat must be valved from a roof to prevent intolerable working conditions you can all too easily get a white elephant up there both in terms of inefficient ventilation and excessive costs. We believe you will find it wise to talk over your high-temperature problem with Allen engineers.

We say this without qualification because the Allen Laminar-Flow Ventilating Roof Valve can open up 91.5% of a roof for ventilation purposes. No other unit can match this performance.

Competitive figures on a recent job showed that Allen was able to provide huge quantities of gravity ventilation with only 114 tons of steel. Standard designs using a bi-furcated air stream approximated 260 tons or 128% more steel to do the same job. Excess cost of the steel alone would be approximately $11,000. Naturally, installation costs, fabrication costs and transportation costs are conconsiderably lowered. ***Allen is the only manufacturer in the United States that can offer you a large area gravity type ventilating roof valve that has better than 80% free area within the limits of its case.***

If you have a high-temperature relief problem, tell us how many BTU you put in the building or figures from which we can calculate it—tell us what final temperatures you can permit under the roof and we will give you an advance calculation based on modern psychrometric practice that will give you an intelligent estimate of exactly what you can expect in your own plant. A cross-section and plan of the building together with the source of heat production will also assist considerably. *The Allen Corporation, 9751 Erwin Avenue, Detroit 13, Michigan.*

THE *Allen* CORPORATION

ENGINEERED VENTILATION FOR INDUSTRY

Now Available

This comprehensive Low Cost

GROUP ACCIDENT AND SICKNESS INSURANCE

will help you solve a No. 1 Problem

MOST employers are today well aware of a definite, widespread condition among their people, an urgent desire for protection against loss of income resulting from accidents and sickness. It is a condition that places a problem squarely in the laps of management: how can this protection which has become so important in the eyes of the workers be best provided?

To help you solve this problem ...practically, completely, economically ... American Mutual suggests that you investigate their Group Disability Insurance Program. For example:

IT IS COMPLETE

• To assure income during periods of disability, American Mutual's Plan provides for generous Loss of Time Benefits.

• To provide immediate cash in case of death or dismemberment, American Mutual's Plan includes lump-sum payment.

• To lessen the burden of hospital bills, American Mutual's Plan provides for liberal hospital expense allowances.

• To provide employees with the financial means of securing adequate surgical attention, American Mutual's Plan offers broad surgical-expense allowances.

• To extend hospital and surgical expense protection to employees' families, American Mutual's Plan offers these benefits to dependents.

COMPLETE!...AND ECONOMICAL TOO

In addition to offering unusually broad benefits, American Mutual, just as it does on all coverages it writes, offers savings opportunities on Group Insurance. Since 1887 dividends to policyholders have never been less than 20%; have made it possible for policyholders to save at least one-fifth on the cost of their insurance. Why not write today for complete details about American Mutual's Group Disability Insurance? (Remember: In some states, this insurance is handled through American Mutual Affiliates.)

Your helping hand when trouble comes!

AMERICAN MUTUAL
LIABILITY INSURANCE COMPANY

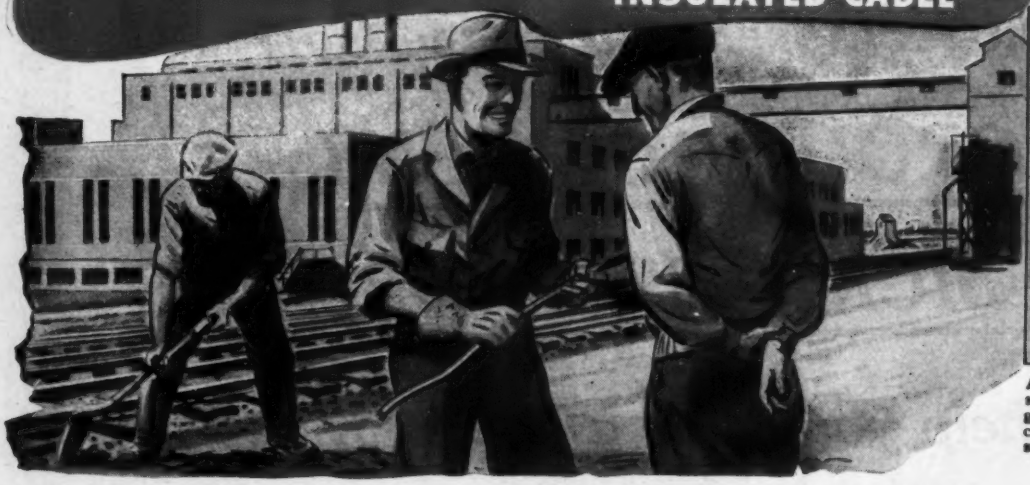
Department F 6
American Mutual Liability Insurance Co., 142 Berkeley Street, Boston 16, Mass.

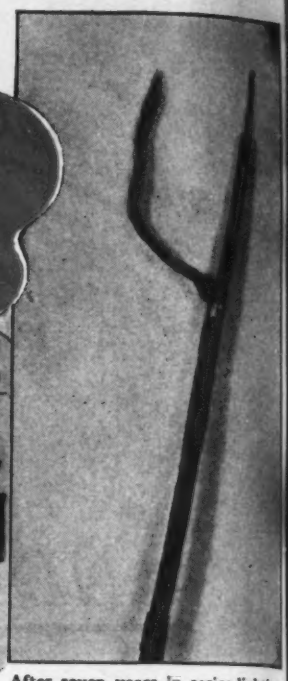
Please send me prospectus explaining more fully the details of American Mutual's Group Disability Insurance.

Name.....

Address..... *City and State*.....

Seven-year Burial proves superiority of FLAMENOL INSULATED CABLE





After seven years in series-lighting service, buried directly in the ground, this two-conductor, concentric No. 8 Flamenol cable is still as good as new.

FLAMENOL'S LASTING PROPERTIES GIVE LONG, ECONOMICAL SERVICE UNDER SEVERE OPERATING CONDITIONS

More than six years before Pearl Harbor, an Eastern power company made a direct-burial installation of Flamenol cable. After seven years' service, part of it was removed and the insulation was tested—with these results:

Physical Condition: *Excellent*

Insulation Resistance: *336 megohms per 1000 ft*

Tensile Strength: *2560 lb per sq in.*

Elongation: *220 per cent*

Many thousands of feet of Flamenol have since been installed underground for series lighting and 600-volt power circuits. Tests after varied lengths of service show that physical and electrical characteristics of the insulation remain practically unchanged.

Specially developed for severe operating conditions

Years before any rubber shortage, G-E engineers turned to synthetic resins for improved cable insulation. Flamenol, the first such cable to be utilized commercially, proved vastly superior to rubber-insulated cable for service under adverse conditions.

Today, after years of constant development, Flamenol cable offers a wide range of operating advantages:

FLAME RESISTANCE

Does not support combustion.

CORROSION RESISTANCE

Immune to action of oils, acids, alkalies.

AGING

Does not oxidize. Highly resistant to sunlight and weathering.

PHYSICAL PROPERTIES

Tensile strength, 1500 lb per sq in., minimum. Elongation, 100 per cent, minimum.

DIELECTRIC STRENGTH

720 volts per mil, retained through severe operating conditions.

In addition to these *time-proved* operating advantages, Flamenol cable is easy and economical to install and maintain. That's why millions of feet of this long-lived cable are used for power and lighting circuits in the chemical, food, textile, printing, oil, mining, steel, automotive, railroad, and other industries. For detailed information on uses, constructions, sizes, etc., write for Leaflet GEA-2733D. *General Electric Company, Schenectady, N. Y.*

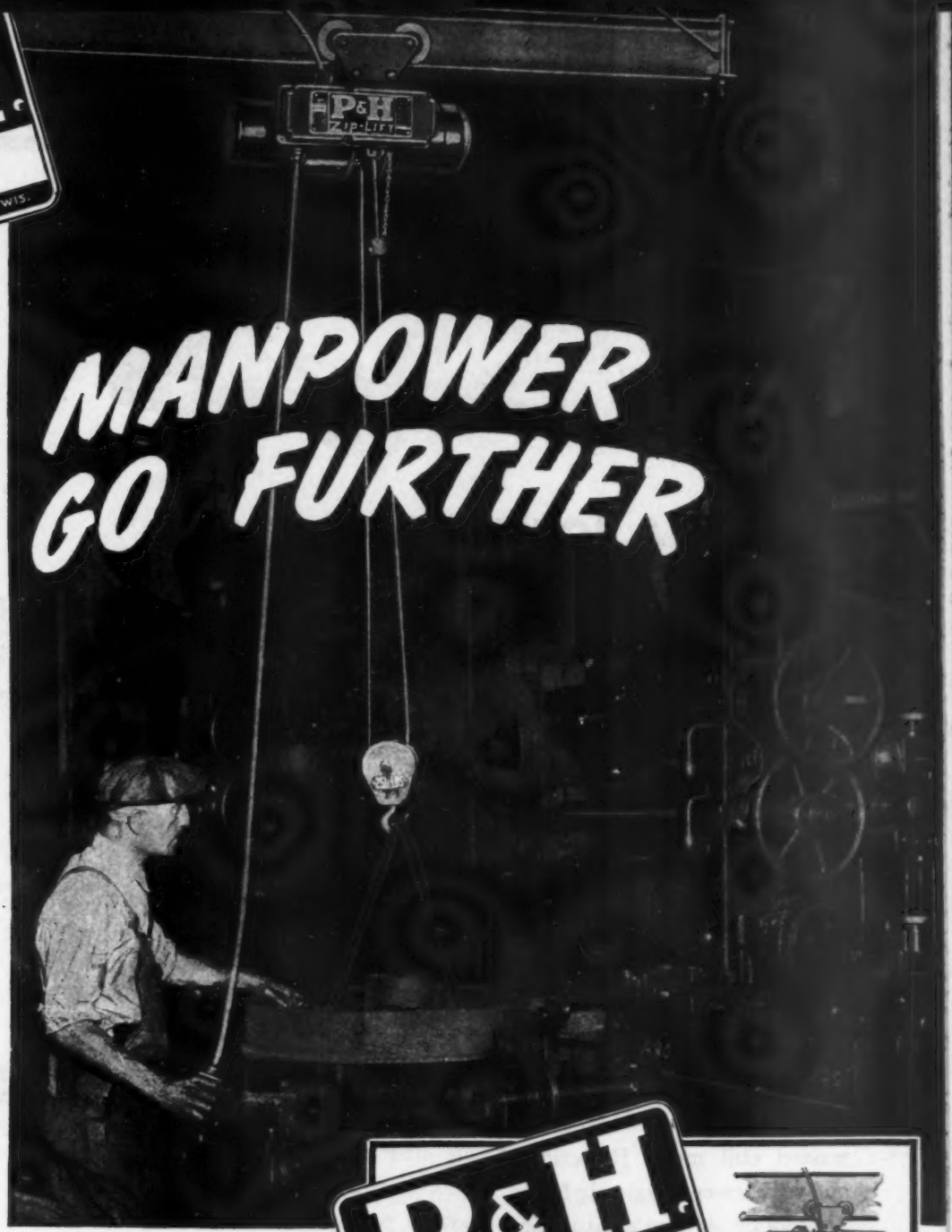
7 Extras That Insure EASY INSTALLATION, ECONOMICAL MAINTENANCE

1. SMALL DIAMETER saves space, facilitates wiring.
2. SMOOTH SURFACE assures easy pulling.
3. FREE STRIPPING speeds splicing, avoids nicking conductors.
4. DIFFERENT COLORS simplify circuit tracing.
5. VARIOUS CONSTRUCTIONS to suit special applications.
6. SELF-PROTECTING finish eliminates need for conduit.
7. RETAINS ATTRACTIVENESS makes re-painting unnecessary.

GENERAL ELECTRIC

P&H
ZIP-LIFT
HARNISCHFEGER CORP. MILWAUKEE, WIS.

MAKE MANPOWER GO FURTHER

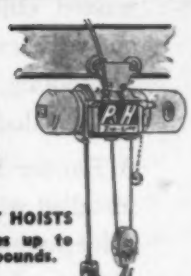


For conserving vital manpower . . . for saving energy . . . for speeding up the handling of materials . . . and for eliminating aisle congestion . . . P&H Zip-Lift Hoists provide the quick, easy answer.

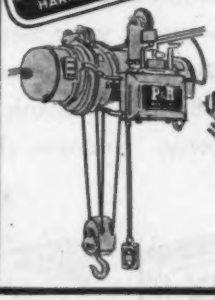
These modern electric hoists can be installed anywhere — quickly. With simple, full magnetic push button you have safe control — lifting, moving and lowering is fast and effortless. Zip-Lifts pay for themselves on an average of twice a year.

See how P&H Hoists can give you greater production today — and how they will aid you in lower cost production tomorrow. Call in a P&H Hoist Engineer. There is no obligation. Or if you wish, send for a copy of Bulletin H20-1.

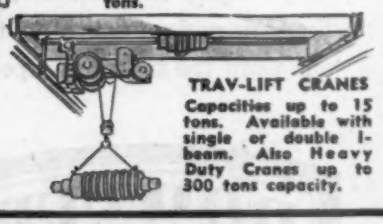
P&H
ELECTRIC HOISTS
HARNISCHFEGER CORP. MILWAUKEE, WIS.



ZIP-LIFT HOISTS
Capacities up to 2,000 pounds.



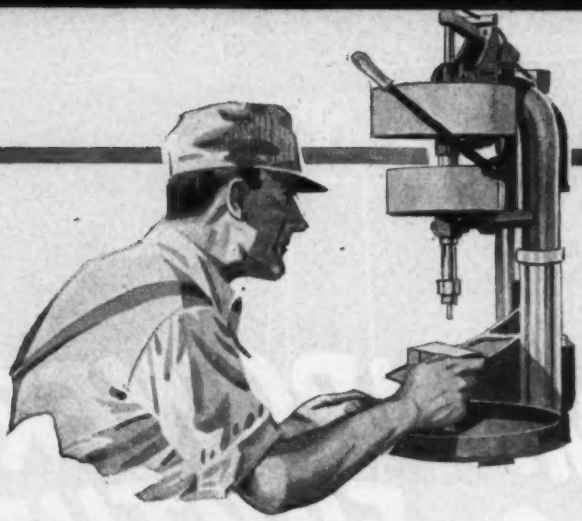
HEVI-LIFT HOISTS
Capacities up to 15 tons.



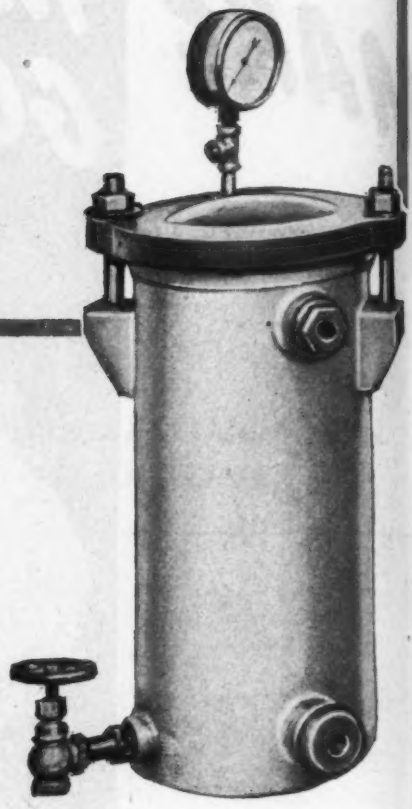
TRAV-LIFT CRANES
Capacities up to 15 tons. Available with single or double I-beam. Also Heavy Duty Cranes up to 300 tons capacity.

General Offices:
4525 W. National Avenue, Milwaukee 14, Wisconsin

HARNISCHFEGER
CORPORATION
HOISTS • WELDING ELECTRODES • MOTORS P&H EXCAVATORS • ELECTRIC CRANES • ARC WELDERS



HOW A BOWSER FILTER IN AN INDIANA PLANT *Tripled Tap Life and Paid for Itself in 30 Days . . .*



An Indiana plant now devoted to war work had a bottleneck—taps. Taps used in the production of 20 mm. shells were wearing out too fast . . . steel particles in the cutting oil chewed them up. New taps were scarce. And expensive. Changing taps wasted time and redressing wasted still more. Rejections and scraps were tragically high. No fooling, it was a situation that needed a quick cure.

A Bowser Pressure Filter was installed with one tapping machine, as a test. Complete elimination of the abrasive in the oil promptly tripled the life of the taps and, of course, cut to one-third the time and expense of changing and redressing.

That's only part of the story, though. Scrap shells, due to faulty tapping, were virtually eliminated. Rejections, due to undersized threads, were reduced 85 per cent.

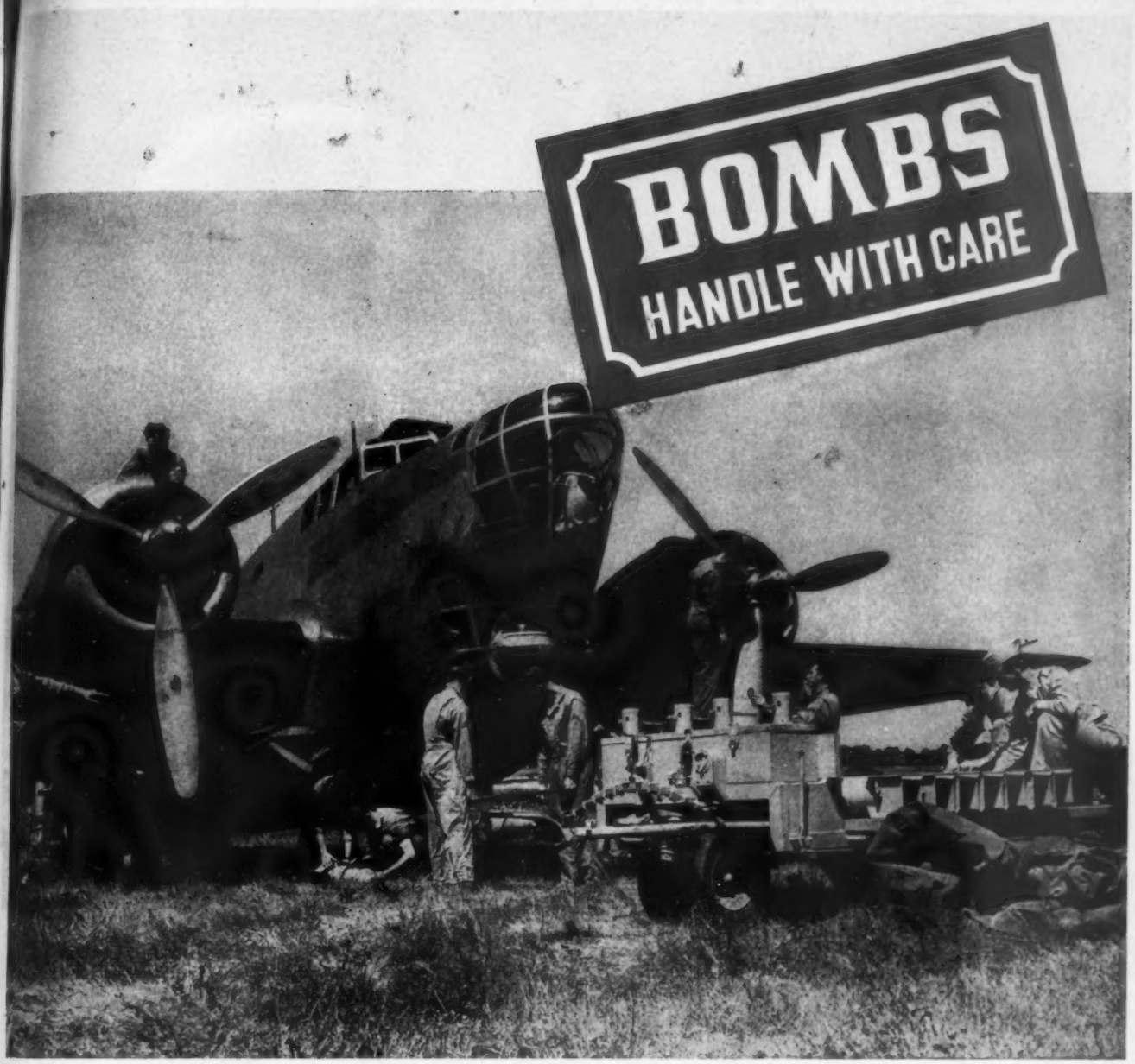
And plant executives figured that the filter paid for itself in less than thirty days. Filters were, of course, promptly installed with all other machines in the plant.

Filters are only one of the many types of Bowser equipment that, chances are, would make your plant operation more efficient, more productive, more economical. There are, for instance, Bowser meters, proportioners, lubrication units, pumps, stills, oil conditioners . . . with indispensable applications in virtually every plant. *Wherever liquids are handled, there's a need for something that Bowser makes.* BOWSER, INC., Fort Wayne, Indiana.

BOWSER ESTABLISHED 1885

BUY WAR BONDS

LIQUID CONTROL SPECIALISTS SINCE 1885



Nobody—not even the ground crew of the B-18 you see here—wants to play rough with bombs. And that's why the chaps who are responsible for transporting loads of bombs from dump to magazine area and from magazine to plane approve of the highly maneuverable bomb trailers built by Saginaw Products Corporation. These sturdy trailers carry tons of treacherous T.N.T. safely over bumpy roads and fields. They don't jack-knife when reversed; they don't sway when pulled along at top speed either singly or in trains.

Designing and building equipment to carry heavy loads safely and speedily is not a new thing to Saginaw Products Corporation. For more than twenty years we have been helping industry get things moved smoothly and quickly—around plants and yards. When conditions permit, our old experience with equipment for industry plus our present experience with equipment for war will be at your service to help you get things moved safer, faster and better than ever before.

SAGINAW PRODUCTS CORPORATION

68 WILLIAMSON STREET • SAGINAW, MICHIGAN

(FORMERLY **SAGINAW STAMPING AND TOOL CO.**) SAGINAW, MICHIGAN

The AIR ARM of INDUSTRY

Applying Compressed Air for countless jobs is one of Ingersoll-Rand's major contributions for the industries of war and peace.

Armies of drill runners mining the vital metals, building the strategic roads and air fields, driving the tunnels for highways, railroads and water—all with rock drills powered by Compressed Air.

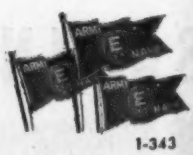
Thousands of men, women too, building planes, ships, tanks, autos, trucks, locomotives, bridges, machines, and process plants—with drills, grinders, riveting hammers, chippers, hoists—powered by Compressed Air.

Today's war production also emphasizes the use of Compressed Air for propelling torpedoes, scavenging guns, starting Diesels, for painting, for ship salvage, for blasting sirens, for inflation of tires, for blowing blast furnaces and cupolas to increase steel production. . . .

Ingersoll-Rand has pioneered Compressed Air Systems since 1871, ever developing new and time-saving applications.

Ingersoll-Rand

11 Broadway, New York, N. Y.



1-343

COMPRESSORS • TURBO BLOWERS • ROCK DRILLS • AIR TOOLS • OIL AND GAS ENGINES • CONDENSERS • CENTRIFUGAL PUMPS

REDUCE CHANCES OF PRODUCTION ERRORS

Send us one of your forms
and we will make up a
transparent holder
without cost or obligation to you.
transparent plastic record holders
protect all factory work sheets
from soiling and mutilation
1 Protect all traveling records and work orders against grime, grease, dirt, tearing, loss
2 Reduce Production Errors due to damaged work orders
3 Save wasted Man Hours deciphering soiled instructions
4 Eliminate mistakes from reading blurred or smudged records
5 Crystal clear, non-combustible, moisture and soil proof

For your
shop orders
inspection cards
blue prints
instruction sheets
route cards
job tickets
travelers, etc.

As pioneers in this business, we bring you the greatest wealth of experience in designing and making holders for all types of production forms. Let us design for you a transparent holder for any special form you have. Tell us the quantity you may be interested in. We will make up a special holder and quote. No cost or obligation of any kind.

JOSHUA MEIER CO. 34 East 10 Street, New York 3, N. Y.

STOP CORROSION WITH *Amercoat* PLASTIC COATINGS

"Stop corrosion" is a *must* on every production front. This demon of destruction works day and night. Silently, insidiously, he attacks vital equipment, structures, products. He is the villain in many a drama of delayed production, of too-high maintenance costs.

Amercoat thermoplastic coatings assure *positive protection* against corrosion. That is why more and more progressive manufacturers in various industries are applying Amercoat to pumps, machines, ventilating systems, air conditioning units, batteries, cooling towers, urinals, pipe, refrigerating plants, dust collectors, floors, walls and other structural surfaces.

Factories, plants and shops also benefit by Amercoat's *dual* protection. In addition to preventing corrosion by acids, alkalies and vapors, Amercoat protects food, liquids, and other sensitive products or supplies from *contamination*.

We invite your request for an illustrated booklet.

"We found Amercoat coating in good condition after months of exposure to sulphuric acid. It's the best coating for preventing corrosion we have ever used."
... writes Purchasing Agent of a stampings manufacturer.

Amercoat...
The Finishing Touch to Industrial Permanence

Odorless, tasteless, chemically inert.

Easily applied, cold, by spray or brush, to metal, concrete, wood.

Tough, durable, flexible.

Unaffected by acids, alkalies, salts, oils.

Compounded to meet specific requirements.

Dual protection against corrosion and contamination.

"A NAME EVERY FACTORY MAN SHOULD KNOW"

YOUR ASSURANCE OF 100% RESULTS

Your letter explaining your particular problem will receive the attention of our technical staff. Amercoat will be recommended for your use *only* after thorough analysis or past experience definitely proves its practical value. Descriptive booklet sent on request.

MANY INDUSTRIES USE AND ENDORSE AMERCOAT

Such as:		
Chemical	Petroleum	Food
Bottling	Construction	Transportation
Marine	Concrete	Sewage Disposal
Shipbuilding	Fishing	Brewing
Hospital	Mining	Soap
Photographic	Canning	Dairy
Distilling	Aviation	Beverage
	Laundry	Wine

AMERICAN PIPE AND CONSTRUCTION CO.
P. O. Box 3428, Terminal Annex, Los Angeles, California

NEW TOOLS FOR OLD

FOR ONLY 15 CENTS* ON THE DOLLAR!

REGRINDING BY NEW TOOL CRAFTSMEN

As originators of Midget Milling cutters, Severance tool makers have the "know-how" when it comes to regrinding worn, dulled tools.

In the regrinding of a worn tool the process is the same as the grinding of a new one. Each flute must have the correct pitch and depth so the finished tool will take deep sharp bites without chatter.

After being accurately reground, your renewed tools are further improved by the "Severite" heat treat process that gives additional hardness to the teeth and increases the cutting life from three to five times.

Worn rotary files, can also be converted into sharp, good-as-new Midget Milling cutters by Severance craftsmen.

Check up on the worn and dulled tools in your plant now. For best service, send them to the Severance plant nearest you for a factory regrinding job.

★ OUR LIST PRICE.

Severance

MIDGET MILLING CUTTERS • PRECISION REGRINDING
SEVERANCE TOOL INDUSTRIES INC., SAGINAW, MICH. •
PLANTS IN LONG ISLAND CITY, N.Y.; DETROIT, MICH.;
FORT WAYNE, IND.; CHICAGO; AND LOS ANGELES

"YOU'LL LIKE WORKING HERE

. . . they treat you like people"

"I know you never worked in a factory before, Mildred, but you'll like it here, and you'll stay. The foreman told me that, when I started here . . . but I'd been around, see . . . so I thought it was some of that morale-buildin' malarkey like they try to hand out in some plants.

"But this plant *is* different. Maybe the reason is, like the foreman said, 'The Old Man never forgets that folks are people.'

"I guess us women appreciate that even more than men do—that, and havin' the management do things for us to make us feel at home.

"Take for instance, this plant is always comfortably warm, no matter how cold it gets outside. 'Tisn't an Eskimo's igloo one time and a Turkish bath another . . . you're not catchin' cold all the time either.

"I haven't had a cold keep me away from work in I don't know how long. Just yesterday I happened to mention that to the foreman . . . and all he said was, 'What do you think the Old Man put in Modine Unit Heaters for?'"

HORIZONTAL DELIVERY MODEL

Catalogs 143-A and 143-B will tell you why.

IN YOUR POSTWAR FACTORY PLANNING INCLUDE MODINE UNIT HEATERS

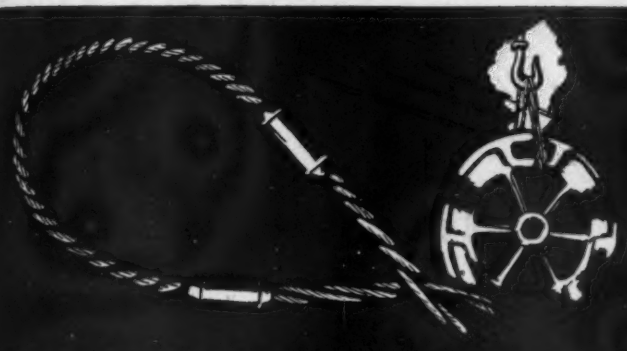
modine

UNIT HEATERS

Look in your phone book for Modine representative's name—"Where to Buy It" section.

MODINE MANUFACTURING COMPANY, 1730 RACINE STREET, RACINE, WISCONSIN

FOUR RESULTS *of wire specialization*

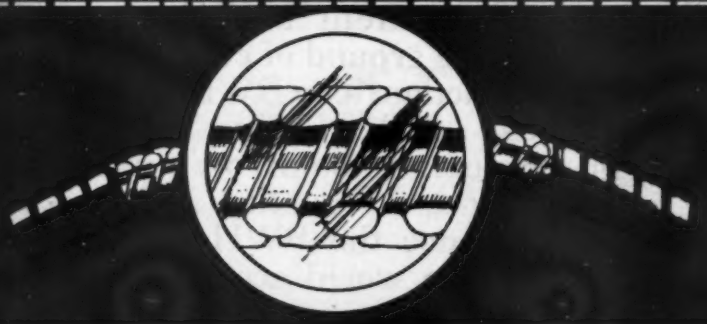


GIVING A LIFT

To all kinds of loads, Roebling wire rope slings are designed for specific industrial jobs. "Flatweave", illustrated, handles light and medium industrial loads with ease and safety. Others lift aircraft engines, airplanes . . .

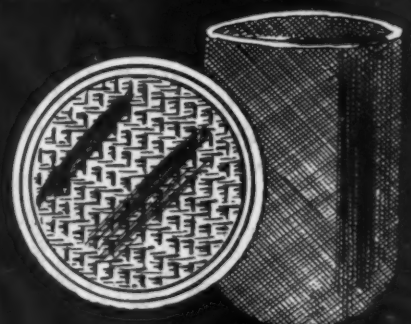
HIGHER TEMPERATURES

In power, heating and lighting cables call for Roebling Varnished Cambric Insulated Cable. On lines up to 5000 volts, for example, operating temperatures can safely go as high as 85° C. . . .



ROEBLING SHAPED WIRES

Made to your specifications reduce time required for fabrication of finished goods. These two, for example, combine to provide tough armor for flexible shafts . . .



WITH TOLERANCES CLOSER

Operating speeds higher, lubricants and other liquids used for today's engines and machine tools must be kept clean. Designers specify Filter Cloth (metallic) from Roebling, supplied as fine as 325 mesh per in., woven of .001" wire . . .

ROEBLING

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

PACEMAKER IN WIRE PRODUCTS

Wire Rope and Strand • Fittings • Electrical Wires and Cables
High and Low Carbon Acid and Basic Open Hearth Steels
Wire Cloth and Netting • Aerial Wire Rope Systems
Suspension Bridges and Cables • Round and Shaped Wire
Cold Rolled Strip • Aircord, Swaged Terminals and Assemblies

WHEN THE *Drums of War* ARE STILLED

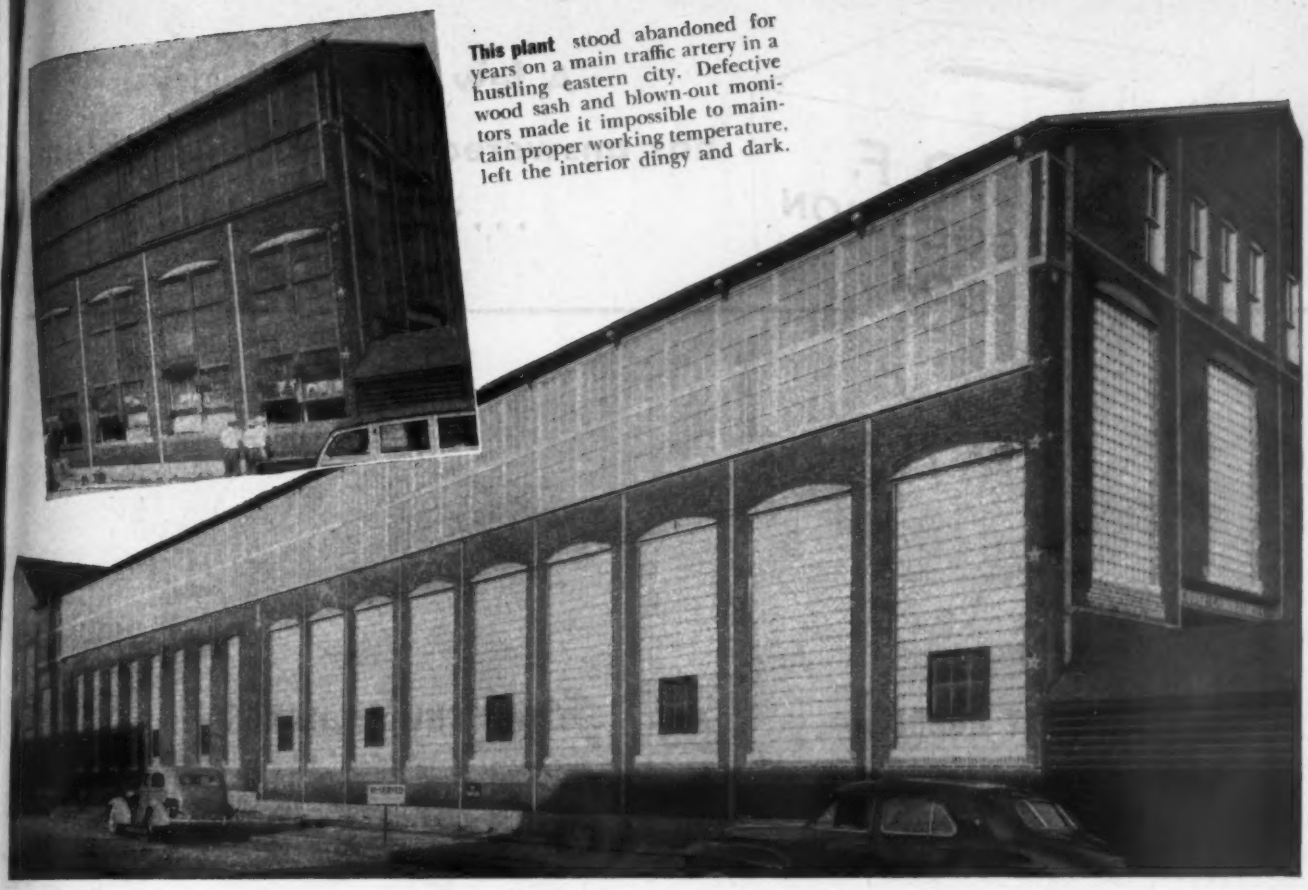
With the coming of Victory will come Victory's products — astonishingly new, amazingly improved. Many of these achievements will emerge — are now emerging — logically and naturally — from one of the world's largest plants devoted exclusively to the manufacture of mechanical rubber goods — from 60 years of history-making invention and advancement and the vast proving ground of current war production. The BWH belting, hose and similar rubber products of tomorrow will outdistance in quality and performance the BWH products that the world accepts as the finest today.

WORKS: CAMBRIDGE, MASS., U. S. A.

P. O. BOX 1071, BOSTON, MASS., U.S.A.

• BOSTON WOVEN HOSE • AND RUBBER COMPANY

BWH



This plant stood abandoned for years on a main traffic artery in a hustling eastern city. Defective wood sash and blown-out monitors made it impossible to maintain proper working temperature, left the interior dingy and dark.

Thanks to PC Glass Blocks

this old plant is now back in production

THE building was restored to active service by the installation of PC Glass Blocks in large lighting areas, new sash in monitors. Now, comfortable warmth and ample light help workmen to fabricate, assemble, weld and paint a wide variety of items.

After 8,000 Light Directing PC Glass Blocks were installed in outside openings, 4,000 additional blocks in the interior—it became an efficient plant. The owners are also highly gratified by its appearance and by the additional privacy made possible by PC Glass Blocks.

THREE EASY STEPS

To replace worn-out sash with PC Glass Blocks you simply: (1) Remove all the worn sash. (P.S. Scrap that metal, it is needed badly) (2) Adjust openings for block sizes, allowing for mortar and expansion joints. (Install new chases if necessary.) (3) Have openings filled with glass blocks by a regular mason, using ordinary tools.

GET THEM NOW

PC Glass Blocks are available for shipment *now*. They can be installed without using any restricted materials. We shall be glad to send you complete information upon request. Just fill in and mail the convenient coupon and your copy of our free book will be forwarded promptly.

PITTSBURGH PC CORNING

GLASS BLOCKS

Distributed by

PITTSBURGH PLATE GLASS COMPANY

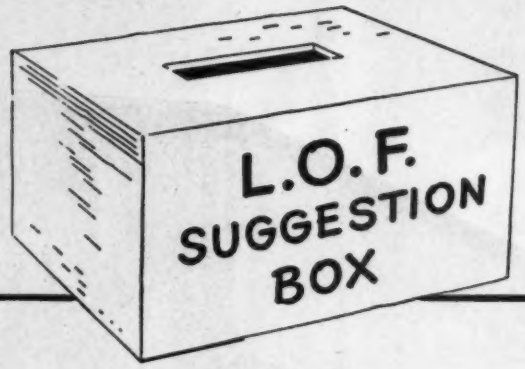
and by W. P. Fuller & Co. on the Pacific Coast

Pittsburgh Corning Corporation
2093-4 Grant Building, Pittsburgh 19, Pa.
Please send me your free book on PC Glass Blocks. It is understood that I incur no obligation.

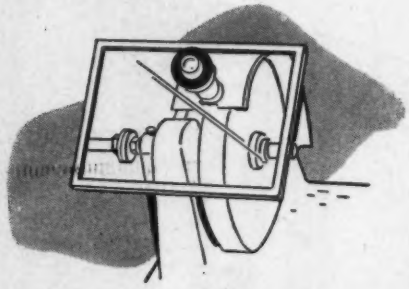
Name_____

Address_____

City_____ State_____

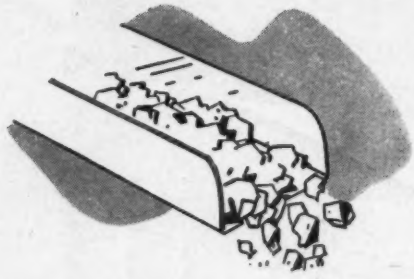


A few ways industry has answered production problems ... with *Glass*



Glass SAFETY GUARDS

Many modern grinders now come equipped with their own goggles. Libbey·Owens·Ford Safety Glass keeps sparks and particles from flying into workers' eyes—but allows full visibility of the work. Workers' forgetfulness about wearing goggles is double-checked when this protection is provided.



Glass CHUTE LININGS

Glass is proving that it is no mollycoddle. In many plants, its abrasion and corrosion resistance has been put to use in chutes of various types—for grain, salt, coal, coke—just to name a few. The result? Longer life for chutes that formerly were worn down quickly by abrasive materials and by corrosion.

Glass PARTITIONS FOR WORKERS

Here's an excellent way to give each worker some degree of privacy without creating a "cooped-up" feeling. Use a partition of translucent glass down the middle of the worktable. It transmits light—prevents shadows that other materials would create. Yet it guards workers from distractions due to movements of workers across the table.

Glass is a truly versatile material. Transparent, of course. But also hard, smooth, strong, acid-resistant, weather-resistant. It can be tempered for extra strength and for resistance to thermal shock.

Think about these properties of glass as you work out your own problems. Possibly glass can help you. We'd welcome the opportunity to show you how. Libbey·Owens·Ford Glass Company, 5834 Nicholas Bldg., Toledo 3, Ohio.

L O F

LIBBEY·OWENS·FORD

A GREAT NAME IN *Glass*

MUSIC CUTS ABSENTEEISM !

ABSENTEEISM in war plants may indicate excessive worker fatigue, boredom, or poor morale.

Industrial music has materially reduced absenteeism in a number of industries.

Nervous tension of workers is relieved and worker spirits boosted by the use of selected music at fatigue periods occurring during each shift. Many users report that greater safety consciousness is an additional benefit of music.

Results of research to date prove that:

(1) Productive efficiency is increased with piece workers.
(2) Quality of work is improved; rejects lessened.
(3) Dispensary visits are decreased.
(4) Morale is better; workers *like* music.
(5) Absenteeism is reduced materially.

These results, actually proved by scientific research, can be reproduced in other plants. Why not yours? An RCA sound system suitable for industrial music also provides paging facilities for locating key personnel quickly, for point to point communication, and for emergency maintenance work; it is also an excellent medium for reaching all employees instantly.

RCA Industrial Music Service

Besides supplying complete sound systems, RCA Industrial Music Service provides selected recordings from the great library of RCA Victor and Bluebird music.

Subscribers to this service also receive the benefits of RCA Psychological Research on industrial music and the help of RCA specialists in planning effective programs.

Free Booklet

The story of industrial music and what it can do for you is told in the new booklet "Manpower, Music, and Morale" sent without obligation on request. Send the coupon, or write to RCA, Industrial Music Service **(70-60B)**, Camden, N. J.

RCA INDUSTRIAL MUSIC SERVICE

RCA

FREE! This new 16-page book telling how to use music in industry, and what it can do for you.

RCA, Industrial Music Service (70-60B) Camden, N. J.
Please send the booklet "Manpower, Music, and Morale" to:

Name.....

Company.....

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RADIO CORPORATION OF AMERICA

"IMPOSSIBLE WEATHER WE'RE HAVING," *said the Sergeant*

We-e-l-ll, not exactly impossible.

After all, the stratosphere has been up there some seven miles and more above the earth for a long time. But only recently has it been possible for man to *create* stratosphere weather with its extremely low temperatures and atmospheric pressures.

General Electric equipment that fills a test chamber with "impossible" weather points the way to better air conditioning for homes, stores, factories, schools, theaters . . . because we've learned how to make air conditioning equipment more compact, more efficient, with balanced and uniform control over a wider temperature-humidity range. And we've found, too, how air conditioning helps to lower production costs.

That's a preview of your air conditioning of the future. It's coming—definitely—because the kind of equipment that will make it possible already has been installed, tested, proved in war-industry applications. Investigate! Write—*General Electric Company, Air Conditioning and Commercial Refrigeration Divisions, Section 443, Bloomfield, New Jersey.*

☆ BUY WAR BONDS ☆

Air Conditioning by

GENERAL ELECTRIC

Hear the General Electric Radio Programs: The "G-E ALL-GIRL ORCHESTRA" Sundays, 10 p. m., EWT, NBC..."THE WORLD TODAY" News, Every Weekday, 6:45 p.m., EWT, CBS

WHERE CAN YOU USE A FILTER THAT IS CONTINUOUSLY CLEANABLE...

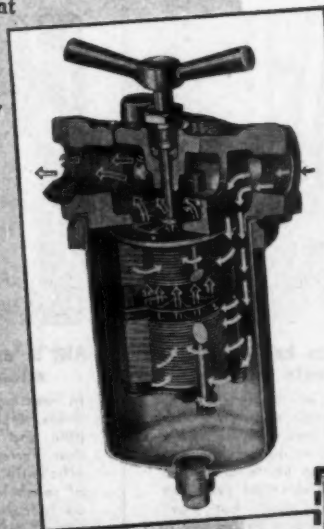
- compact
- lightweight
- noncollapsible
- easily adaptable to automatic self-cleaning

CHAPTERS ON SUCH APPLICATIONS AS:

- Burners and combustion controls
- Diesel engines
- Food production equipment
- Gasoline engines
- Machine tools
- Metal-working machinery
- Paints, coatings, finishes
- Process industry equipment
- Steel mill lubricating, descaling, cooling systems
- Turbines, blowers, compressors, etc.

Both types of Cuno Filters are described—

CUNO "AUTO-KLEAN"
mechanical cleaning
CUNO "FLO-KLEAN"
hydraulic cleaning



You can get *quick facts* on the operation and application of Cuno "Filter-Fine" Strainers by writing for the free 36-page booklet "Quick Facts".

IT TELLS...

1. How the Cuno Filter may be mounted externally or built into the machine
2. How full flow can be handled by a single Cuno filter no larger than the ordinary partial-flow type
3. How the filter can be cleaned without interrupting fluid flow
4. Why build-up of sticky residue is avoided by an exclusive feature
5. Why the cartridge never needs to be removed for renewal or cleaning
6. Why the filter element will last as long as the equipment on which it is installed
7. How its all-metal construction permits use under a wide range of pressure, temperature, corrosive and erosive conditions

KEEP FLOW ON "GO" WITH

CUNO

THE "FILTER-FINE" STRAINER

CUNO ENGINEERING CORPORATION
603 South Vine Street
Meriden, Conn.

Please send me a free copy of QUICK FACTS

NAME.....

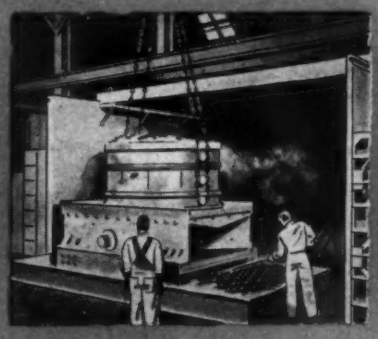
COMPANY.....

ADDRESS.....

Be sure "AIR-AT-WORK"

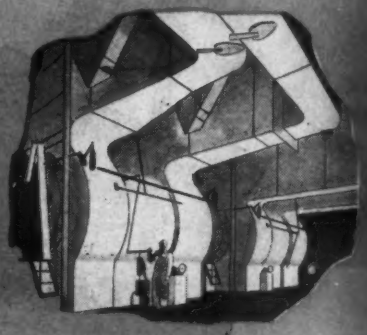
POST WAR PLANNING

A year ago it was unpatriotic to mention the word. Today it is industry's greatest challenge. A challenge that AIR-AT-WORK can help you meet—every step of the way—from designing a better product to making it more efficiently and improving the conditions under which it is made. Sturtevant Engineers have the knack of putting a finger on the *right* spots for air handling equipment. We invite an opportunity to sit down and discuss these applications in terms of *your* operations and products—without obligation.



AIR to grab dust and keep it away from men and machines

Wherever dust will be created, Sturtevant has a special method of keeping it in line, safeguarding both employees and equipment, minimizing the cost of operation. For example, instead of carrying off and wasting heated room air, a new technique whirls it through dust separators, and returns the clean air to the room with all its valuable heat intact.

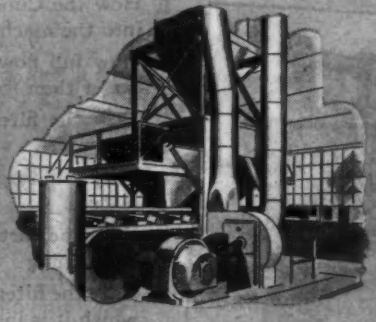


AIR to squeeze the last atom of energy out of your fuel

For tomorrow's power plant boilers, look to Sturtevant for the mechanical draft fans that will meet the demands for higher speeds, large volumes, highest pressures, temperatures and efficiencies. For example, new cyclone furnaces utilize Sturtevant centrifugal compressors to supply air for combustion at 70" pressure.

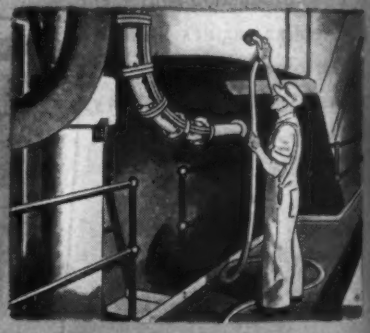
AIR to blast out fumes that keep you less than 100% efficient

If there's even a trace of fume or fog in your plant, look to Sturtevant for improved methods of holding it in check, adding years to the life-expectancy of both men and machines. For example, concentrations of acid fumes which formerly restricted production are now precision-controlled. Production line methods are possible without jeopardizing operators or equipment.



AIR to carry hard-to-handle materials with no waste motion

For handling any sort of loose material, Sturtevant has a pneumatic conveying system that picks it up and lays it down where it belongs without loss or labor. For example, an extra twist that Sturtevant gives one problem not only delivers light yet bulky materials throughout the plant, but thoroughly cleans them of dust and dirt en route.



AIR to spruce up your plant with a minimum of cost and labor

In meeting new standards of plant cleanliness, Sturtevant is headquarters for portable and central system Vacuum Cleaners that ferret out dirt faster, easier, more efficiently. For example, improved methods of reaching into racks, bins and machinery, up to rafters, pipes and ledges, offer new opportunities to minimize health and production hazards, fire and explosion dangers and even to reclaim valuable dust.

Sturtevant Equipment AND SYSTEMS

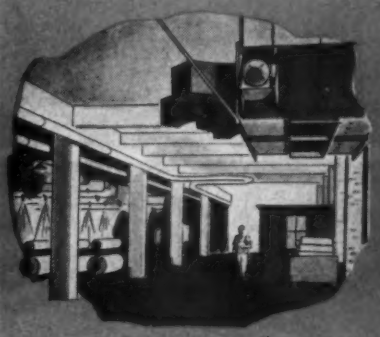
REG. U. S. PAT. OFF.

sits in on your

POST WAR PLANNING COMMITTEE!

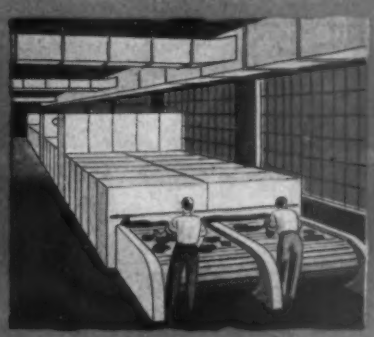
AIR to harness the weather to your production needs

For processes that must pay more attention to indoor weather, Sturtevant is ready with improved equipment and systems that permit matching the installation to the budget and process involved. For example, in the manufacture of ultra-precision instruments, air conditioning controlled within one degree of temperature and humidity makes possible assembly and test adjustments within tolerances of one millionth of an inch



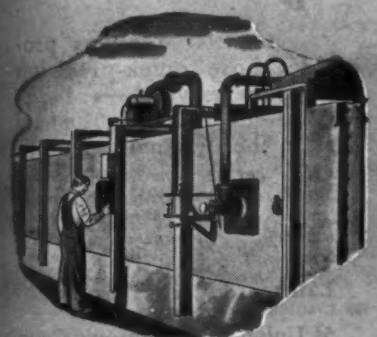
AIR to make every ounce of steam pay off in useful heat

In heating your plant tomorrow, count on Sturtevant for equipment and systems that put heat in the right places at the right temperature, cutting fuel bills in the bargain. Because Sturtevant manufactures all three types of unit heaters as well as central systems, we know what each can do best and which one or combination is best suited to your job.



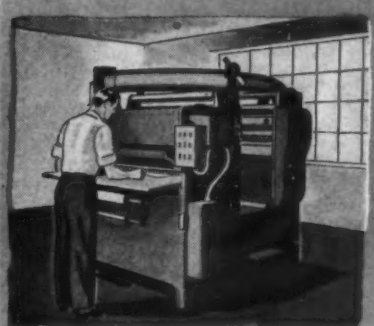
AIR to carry moisture out of your product more efficiently

In drying or dehydrating tomorrow's products, Sturtevant has developed new techniques for extracting moisture in a way that will increase output and improve product quality. For example, an ingenious arrangement of either tapered nozzles and baffle plates or perforated plates and plenum chamber now produces a change of heated air up to 300 times a minute near the material being dried.



AIR to boost up the pressure needed for special process work

When it's time to review production costs again, come to Sturtevant for suggestions and methods of utilizing a blast of high pressure air for closer control of combustion, cooling, drying, cleaning, agitation of liquids and countless other processes. For example, compressors now supplying a constant weight of air to foundry cupolas affect closer control of combustion, improved quality of castings.



AIR to help give your new products a jump on competition

Have you considered how air handling equipment, incorporated in your post-war product, can improve machine performance and product quality? For example, a blue print machine produces better prints faster with a specially designed and applied fan which exhausts heated air from the light chamber and uses it for drying prints more rapidly and uniformly

Why not discuss it with us *now*?

Sturtevant has long experience with ALL types of problems that *air at work* can solve . . . Sturtevant makes a wide range of equipment — and knows which can best lick any ONE problem. Add it up and you have the right place to bring your post-war problems. A Sturtevant Engineer is ready and waiting to discuss your particular needs—and to submit competent recommendations.

B. F. STURTEVANT COMPANY
HYDE PARK BOSTON 36, MASS.
Branches in Principal Cities

Engineered for Efficiency

IN HEATING, VENTILATING, AIR CONDITIONING, DRYING, DUST AND FUME CONTROL, PRESSURE BLOWING, VACUUM CLEANING, PNEUMATIC CONVEYING AND MECHANICAL DRAFT

Sturtevant
Puts Air to Work

Presenting the New

WILLSON MONO *Goggle*

The latest development in plastic eye-protection . . . combining safety, unobstructed vision and the highest degree of comfort.

NOTE THESE ADVANTAGES

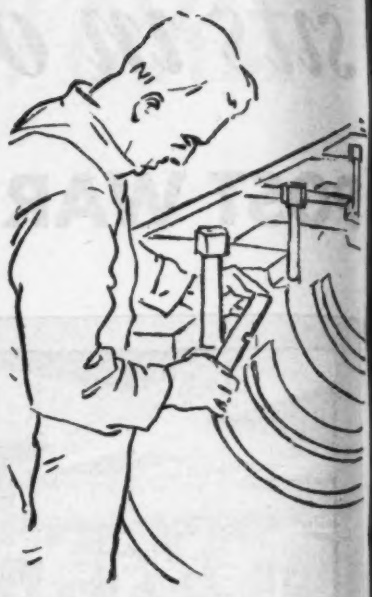
1. Weighs only 1¼ oz., lightest goggle of its type
2. Crystal-clear plastic lens
3. Lens is non-shatterable
4. Lens is replaceable
5. Eye-nose shield an integral unit, leaving no open danger spots
6. High impact-resistance
7. Comfortable over glasses
8. Rolled edge makes smooth contact with face
9. Scientifically ventilated
10. Easily adjusted

GOGGLES • RESPIRATORS • GAS MASKS • HELMETS

DOUBLE WILLSON

PRODUCTS INCORPORATED

READING, PA., U. S. A. *Established 1870*



factory accuracy *in field adjustments*

LAMINUM shims provide those quick-precision adjustments which—as in aircraft—are as vital in the field as in the original assembly.

Shims cut to your specifications. Stock shim materials obtainable from your dealer. Write us for further information and shim application chart.

Laminated Shim Company
Incorporated
54 Union St. • Glenbrook, Conn.

LAMINUM

THE SOLID SHIM THAT *peels* FOR ADJUSTMENT

2040

Give Your Product Designer a Free Hand!

Plan to use Steel—from the complete Republic Line of Flat Rolled Products

● Don't tie your product designer's hands by insisting that he use materials that definitely limit his value to you. Plan to use Steel—the versatile material—and take full advantage of his ability to provide better construction, faster fabrication and cost economies in your postwar products.

The complete Republic Flat Rolled Line offers greater suitability to a wider range of product needs and provides advantages not found in other materials. It includes analyses ranging from plain carbon to stainless steel—forms from light-gauge strip to 90-inch-wide plates—in all commercial finishes.

If you are planning products that must take a tight, smooth, painted or plated finish—or require deep drawing—or need unusual rust-resistance—or possess high strength-weight ratio—or many other qualities, you'll find the material you want in the Republic Line.

This Republic Line is a product of years of experience in steel production, from the ore to the finished product. It has been carefully developed by one of the most extensive steel research, engineering and production organizations. And it will bring added advantages to you on V-day.

Check and see how Republic Flat Rolled Products can improve your plans for better postwar products.

REPUBLIC STEEL CORPORATION

General Offices: • • Cleveland 1, Ohio

Berger Manufacturing Division • Culvert Division
Niles Steel Products Division • Steel and Tubes Division
Union Drawn Steel Division • Truscon Steel Company
Export Department: Chrysler Building, New York 17, N. Y.

Note these trade names for tomorrow's use

TONCAN IRON
{resists rust and corrosion}

ENDURO STAINLESS STEEL
{resists corrosion and heat—lustrous and sanitary}

ELECTRO PAINTLOK
{takes paint readily—holds it}

TONCAN ENAMELING IRON
{easy to fabricate and enamel}

TAYLOR ROOFING TERNES
{long service proved by 133 years' use}

REPUBLIC SILICON STEEL
{high-performance electrical steel}

EX-L-ITE TIN PLATE
{uniform high quality}

Republic

FLAT ROLLED PRODUCTS

SHEETS: Hot and cold rolled—carbon, copper-bearing, alloy and stainless steel—Toncan Iron—electrical, enameling, culvert, galvanized, galvannealed, electro coated, roofing, ternes, oven lining, bonderized. ● STRIP: Hot and cold rolled—coils and cut lengths—electrical, carbon, alloy and stainless steel—Toncan Iron. ● PLATES: Universal, mill edge, sheared—carbon, alloy and stainless steel—Toncan Iron—light armor. ● TIN PLATES: Coke and electrolytic—black plate and bonderized black plate—lacquered and coated in solid colors.

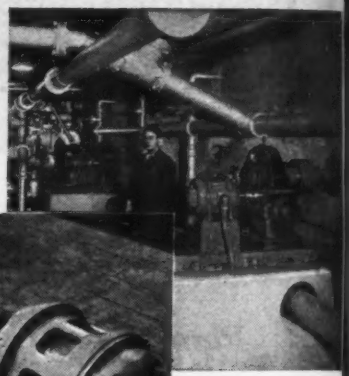
WE CERTAINLY MAKE A LOT OF DIFFERENT TYPES OF SPEED REDUCERS..

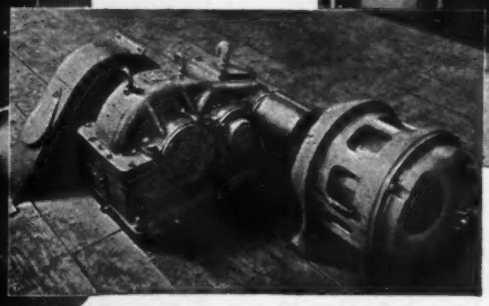
YES, THAT'S WHY WE CAN SUPPLY A DRIVE FOR EVERY NEED!

Long ago, experience showed that the many industrial drive applications could be filled best only from a full line of speed reducing units—therefore we designed and make all types and sizes. Furthermore, each unit is tailored to fit the service. In that way Philadelphia Speed Reducers transmit power efficiently and economically to all kinds of equipment and give years and years of trouble-free service.

Where a self-contained drive is indicated, we recommend the vertical or horizontal MotoReducer.

Tell us your requirements and get our unbiased recommendations on the right type drive for your needs





Shown here are 2 Philadelphia Speed Reducer installations.

ARMY E NAVY

PHILADELPHIA GEAR WORKS, INC.

INDUSTRIAL GEARS AND SPEED REDUCERS LIMITORQUE VALVE CONTROLS

ERIE AVENUE & G STREET
PHILADELPHIA 34, PENNA.
NEW YORK, PITTSBURGH, CHICAGO

Philadelphia LIMITORQUE CONTROL operates all types of valves, etc., safely, economically, from convenient stations.

Philadelphia GEARS All types and sizes of industrial gears. Can be supplied in all materials.

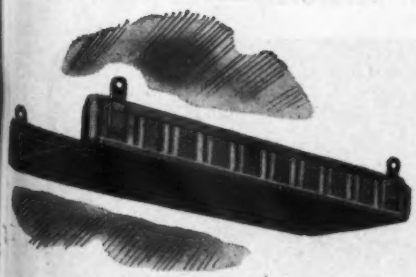
Philadelphia HERRINGBONE SPEED REDUCER for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.

Philadelphia MOTOREDUCER The economical self-contained drive. Horizontal or Vertical types — various ratios and horsepowers.

Philadelphia WORM GEAR SPEED REDUCER right angle drives — vertical or horizontal. Wide range of ratios and horsepowers.

Union Metal MATERIALS HANDLING UNITS
Speed War Production

HERE is a view inside a giant aircraft products plant. The ingenious use of Union Metal Double-Corrugated All-Steel Skids, which have been turned upside down to serve as trays for long bar stock, has brought order out of confusion . . . cleared the floors for action . . . and simplified the fast flow of needed parts.



Union Metal All-Steel Skids, Boxes, and Pallets used in this and other great factories were engineered to do their job better, faster, cheaper. They're rugged, they're adaptable to a multitude of uses, and they're light and easy to handle. The complete line includes a size and type to meet every materials handling requirement. Write for catalog to

THE UNION METAL MANUFACTURING COMPANY, Canton 5, Ohio

UNION METAL
Materials Handling Equipment

HOBART'S ARC WELDING DESIGN
... a service that HELPS YOU PLAN

Initial Sheets are FREE!

No matter what your plans for the future, if you work with metal you can use these design sheets. They will unveil welding practices that guarantee short cuts in production yet give you a better product. Acclaimed by thousands of manufacturers, designers, engineers as the most outstanding contribution to industry in years. Yours for the asking. Write for "Practical Design for Arc Welding" on your letterhead today.

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* PROMPT Deliveries on Welders if Suitable priority.

HOBART
"One of the World's Largest Builders of Arc Welders"

TANNATE LEATHER BELTING

...for ECONOMICAL, LONG SERVICE LIFE

For primary drives—for modern group drives—for pivoted motor base drives—for machines—specify Tannate.

Tannate has great strength and an exceptional pulley grip that keeps machines producing at high speeds even under varying loads and so maintains maximum output. It is resistant to moisture, machine oils and many weak chemicals.

Stronger than most first quality oak belting, Tannate outlasts ordinary belts. Little maintenance is needed to secure long, trouble free service even when running on 3 shift daily operation. However, occasional applications of Rhoads Belt Preserver are recommended.

Rhoads Engineering advice may show you the way to get real belting economy—with Tannate.

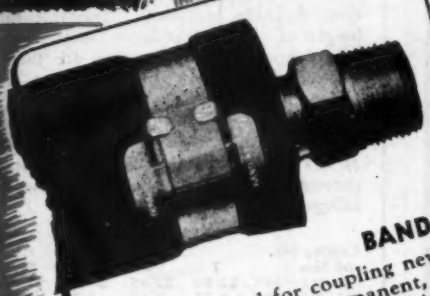
Write for a handy belt length calculator. Figures belt length quickly and accurately — It's free.

STEP UP PRODUCTION with
RHOADS
Tannate
WATERSHED LEATHER BELTING

J. E. RHOADS & SONS • 35 N. Sixth St., Philadelphia 6, Pa.
Established 1702 • NEW YORK • CHICAGO • ATLANTA • CLEVELAND

No Cause for shut-down

BAND-IT



BAND-IT

Ideal for coupling new or old hose. Permanent, leak-proof clamp. Band is flat; permitting strongest grip without cutting hose.

PERMANENTLY MAINTAINED by Manufacturer

One compact, efficient, heat-treated steel tool weighing only 3½ lbs. handles every Band-It job. We maintain all Band-It Tools in first class operating condition at no cost to the user.

In a few seconds and for a few cents, maintenance men lick what might be a disaster—with Band-It Clamps! No wonder Band-Its are on the job thru every industry, in war plants, utilities, and institutions all over the nation.

UNIVERSAL USE ● With one small tool and a roll of Band-It Band and a box of Band-It Buckles, you are all set for clamping everything, from 1/4" to 30 ft. diameter.

SPEEDY ● Band-It repairs to leaky pipes, hose, tanks are made on-the-spot without tearing down or disconnecting any equipment.

STRONG AND DURABLE ● Band-It steel, mill built to Band-It Company specifications, has a tensile strength over 2,300 pounds for the ¾" width. Outlasts the part repaired.

Distributors in all principal cities. Write today for quick-fact Bulletin, with prices, and name of your nearest jobber. Address The Band-It Company, 2536 Walnut St., Denver 5, Colo.

BAND-IT

'QUICK ON THE DRAW'

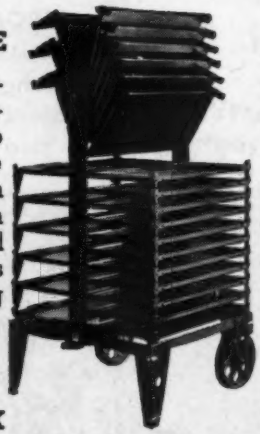
For large and small industrial buildings
Front Office and Engineering Department approve the

TURNER SYSTEM
of MATERIALS HANDLING

Management in every American Plant will be enthusiastic about the scientifically designed Turner System which provides the most practical solution to space problems. At small equipment cost this remarkable system cuts labor, materials handling and storage expense. It saves up to 50% floor space by its mathematically 100% efficient method of handling and storing. It saves the cost of new buildings and the installation of expensive overhead equipment. It definitely reduces material handling accidents which comprise 40% of all industrial accidents.

BUILT on the PRINCIPLE of the SQUARE

The Turner System is a completely standardized scheme of interlocking and interchangeable units which can be applied to every plant operation. Its foundation is the perfect square upon which is built an amazingly flexible and efficient materials handling and storing procedure.



SEND FOR EXPLANATORY BOOK

Factory Service Company will send without charge to established companies its twenty-page book explaining the Turner System. Write for it today.

FACTORY SERVICE COMPANY
4605 N. TWENTY-FIRST ST. MILWAUKEE, WISCONSIN

Speed Sweep
WITH A BACK OF STEEL

MAKES LIGHT WORK OUT OF TOUGH JOBS

Steel back of Speed Sweep brushes is the basis of unique construction for faster, easier, better sweeping. Block is ½ usual size – easier to handle. Tufts of longer, better fibres are more compact – provide "spring and snap" action. Handle instantly adjustable to height of sweeper, reduces fatigue and strain. Speed Sweep brushes are built to outlast ordinary brushes 3 to 1.

Heavy Duty *Speed Sweep* Brushes

of heavy Bassine fibre for rough work through grease, cutting oils, metal filings, etc.

PRICES

Catalog No. and Size	Lots of: 1	6	12	24
No. 411—14"	$2.80	$2.35	$1.95	$1.75
No. 413—18"	3.00	2.60	2.20	2.00
No. 416—24"	3.55	3.15	2.70	2.50

Double Duty *Speed Sweep* Brushes

have two center rows of heavy Bassine fibre for rough dirt and two outside rows of finer Union fibre to control dust.

PRICES

Catalog No. and Size	Lots of: 1	6	12	24
No. 421—14"	$2.95	$2.55	$2.15	$1.95
No. 423—18"	3.35	3.00	2.55	2.35
No. 426—24"	3.85	3.45	3.05	2.80

(All prices F.O.B. Milwaukee—Quantity prices apply on mixed orders.)

FULLY GUARANTEED - ORDER TODAY

Since Pearl Harbor, Speed Sweep brushes have been adopted in thousands of factories. Their superiority has been proved under such varied conditions that they are unconditionally guaranteed to meet your requirements. Order at once for prompt shipment. Extend AA-5 or higher priority rating.

M D
Milwaukee Dustless
BRUSH COMPANY
526 N. 22nd St., Milwaukee 3, Wis.

ONE STATION

Starts – Stops the Entire Heating and Ventilating System . . .

. . . in this MAHON Spray Paint Installation

Here is a modern, gas-fired heating and ventilating system—designed, built and installed by Mahon engineers for the paint room of one of the leading aircraft manufacturers—that attains the *nth* degree in *automatic operation*. It has been so engineered that by merely pressing the "START" button—the entire system is set in operation. Pressing the "STOP" button shuts the complete system down. That's how simple it is. By means of a series of time delays and Mahon Air-Flow Switches, the various units go into service, each in its proper sequence. First, the air supply fans start—the four A.O.P surface combustion gas heaters ignite—and air, drawn from outside, is heated to 80° F., thoroughly filtered and distributed throughout the room. Next the spray booth pumps and fans go into action—the conveyor begin to roll—and the complete system is in operation —all in about a minute's time. Ovens, also, can be hooked in, if desired.

A Mahon engineer will be glad to explain the set-up in detail—and show you how automatic Finishing Equipment can be developed to fit YOUR specific requirements.

THE R. C. MAHON COMPANY

DETROIT — CHICAGO

Manufacturers of Metal Cleaning Machines • Rust Proofing Machines • Hydro-Filter Spray Booths • Ovens of All Types • Filtered Air Supply Units • Hydro-Foam Dust Collectors—and Many Other Units of Special Production Equipment—including Complete Finishing Systems

VARNISHED CAMBRIC INSULATION

is one answer to the rubber shortage

Single conductor. Braid covering.
Three conductor. Lead sheath.
Switchboard wire. Flameproof braid.
Interlocked armor for indoor use.
Non-metallic sheath to protect lead.
Shipboard cable. Metal braid —AIEE type.
Okebestos switchboard wire.
Okebestos power cable.

This booklet—OK-1013A—can help solve your wiring problems.

A recent WPB ruling has forbidden the use of natural rubber in the manufacture of electrical wire and cables for most commercial purposes. To help satisfy *your* wiring needs, why not consider the use of Varnished Cambric insulated cables?

Okonite Varnished Cambric cables are *stable, long-lived* and *easy to handle.* Resistant to heat, oil and ozone, these cables can be used in power circuits for either high or low voltages—for switchboard and control wire—for generator or motor leads—and for many other applications. Okonite V. C. wires and cables are made in either single or multi-conductor construction for all voltages up to 28,000 volts.

Insulated with oil-impregnated cloth, V. C. cables require only a minimum of critical materials. In addition, the higher permissible operating temperature of this type insulation conserves copper by allowing heavier current loadings for a given conductor size.

Okonite Varnished Cambric wires and cables can be supplied in a variety of suitable coverings—lead sheath, wire or metallic tape armor, synthetic jacket, asbestos, or flame-retardant cotton braid. Bulletin OK-1013A contains 36 pages of information on their selection, capacity and installation. Write today for your copy. The Okonite Company . . . Passaic, New Jersey.

VARNISHED CAMBRIC INSULATION IS NOT JUST ANOTHER WARTIME SUBSTITUTE

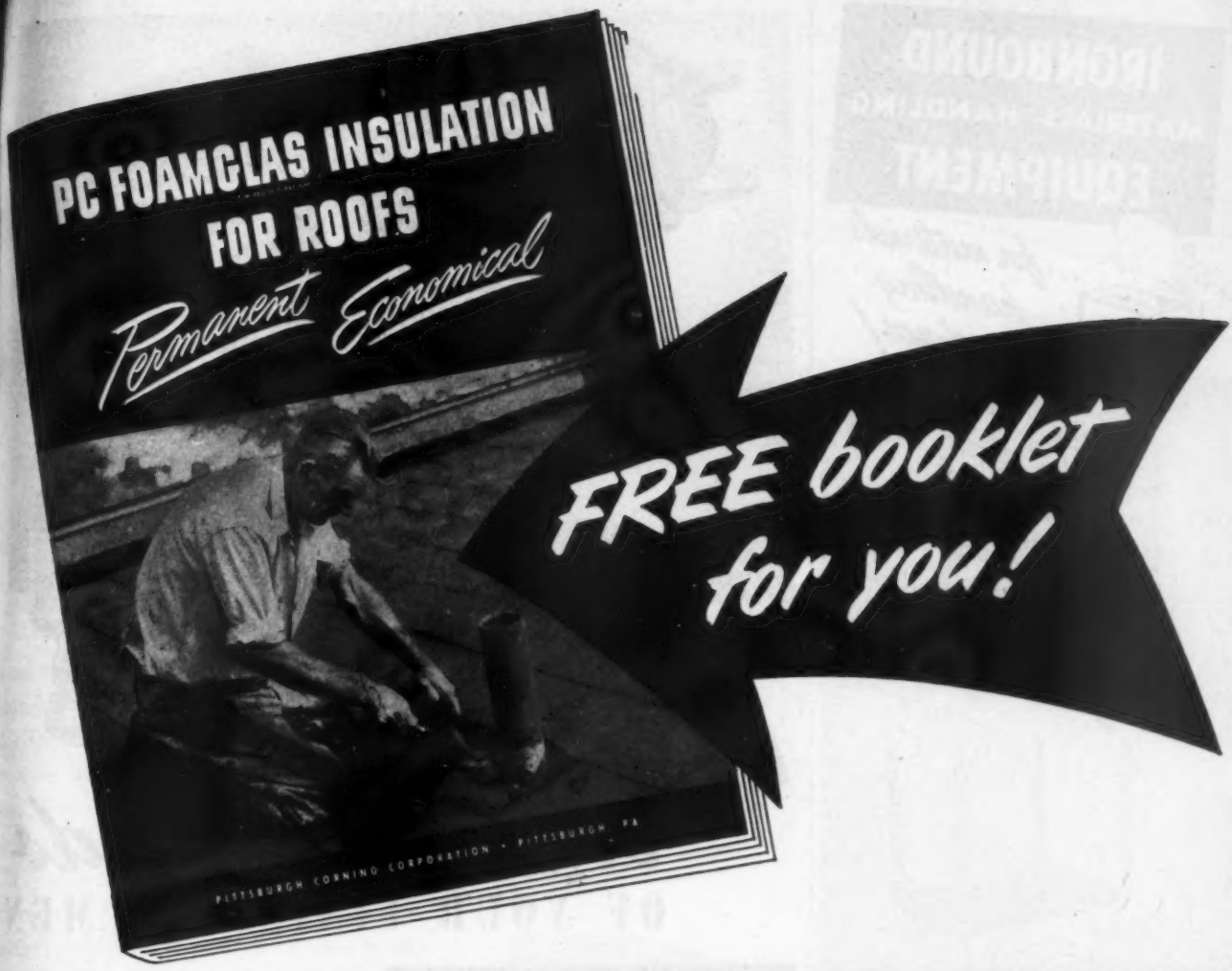
— yet it saves Copper, Tin and Rubber

Varnished Cambric insulated wires and cables were not developed as a substitute to meet a wartime emergency. Okonite has been a leading manufacturer of a complete line of Varnished Cambric wires and cables since 1912. For over 30 years V. C. cables have proved to be exceptionally reliable and long-lived.

OKONITE

INSULATED WIRES AND CABLES

3417



ALL THE FACTS YOU WANT ABOUT PC FOAMGLAS, THE PERMANENT INSULATION THAT IS 9 PARTS AIR, 1 PART GLASS

COMPLETE engineering data, twelve pages of charts, tables, graphs, illustrative photos and explanatory text—all these have been gathered, for your convenience, into our new brochure. In it you will find information that is invaluable to every man who is concerned with insulating procedure in industrial plants.

The brochure includes a full exposition of the characteristics of PC Foamglas, especially its unique abilities as an insulating material for roofs. These same qualities make PC Foamglas the ideal insulation for walls, floors, ceilings, partitions, insulated shields and screens.

Before you plan roof insulation, send for this new free booklet. It will point the way to greater satisfaction —for less money—with PC Foamglas insulation for roofs. Just fill in and mail the convenient coupon.

PC FOAMGLAS

T. M. REG. U. S. PAT. OFF.

PERMANENT INSULATION

9 parts air · 1 part glass

MAIL COUPON TODAY

Pittsburgh Corning Corporation
2071-4 Grant Building, Pittsburgh 19, Pa.
Please send along my *free* copy of your new booklet on PC Foamglas Insulation.

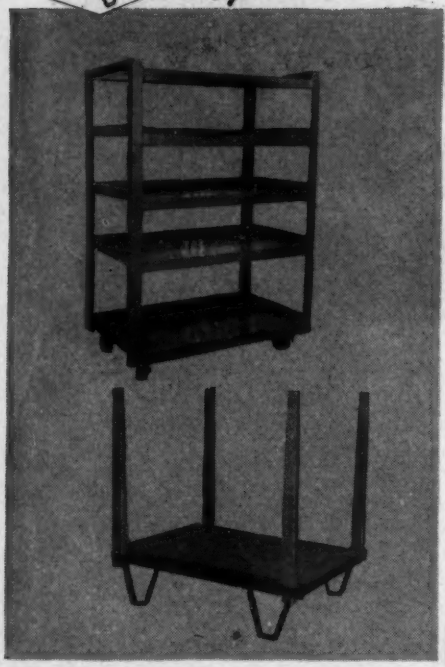
Name_____

Address_____

City_____ State_____

IRONBOUND
MATERIALS-HANDLING EQUIPMENT

...for materials handling speed-ups!



All three basic types of construction—bolted, all-welded or combination bolted and welded — assure maximum service even under severe usage. Available in standard sizes or any special size required, IRONBOUND Skids and Platforms will carry loads up to 20,000 lbs.

IRONBOUND units feature rounded-corners which prevent serious injuries and damage, and tongue and grooved deck construction to provide greater strength and smoother surfaces. Write for illustrated literature.

IRONBOUND BOX & LUMBER CO.
30 Hoffman Place, Hillside, N. J.

IRONBOUND
MATERIALS-HANDLING EQUIPMENT

Put this Gun into the hands
OF YOUR FINISHING MEN

To Speed Production — The Paasche Type CUB High-Production Airbrush provides the fastest method for spraying all types of finishing materials. Its light weight (only 22 oz.), perfect balance and "hand molded" grip enable men or women operators to work longer hours at full production.

To Improve Quality — Its perfect atomization assures finer finishing at top speed. Micrometer calibrated spray pattern control provides precise, easy adjustment for any job.

To Slash Replacement Costs and Headaches — The sturdy construction — with all working parts enclosed in strong, machined brass body — protects against damage and assures longer life. Floating air valve takes up wear, prevents leaks. The CUB stays on the job!

These special advantages of the Paasche High Production Airbrush are typical of the superior quality features to be found in the entire Paasche line. Get the facts and you'll get Paasche Airpainting Equipment.

SEND FOR NEW CATALOG
It Illustrates and describes all the various types of Paasche manual or automatic Airpainting Equipment. Write today for your Free Copy. Paasche Airbrush Co., 1944 Diversey Parkway, Chicago 14, Ill. Paasche Airbrush (Canada) Ltd. 154 Vaughn Road, Toronto.

Paasche AIRPAINTING EQUIPMENT

Manual, automatic and special airpainting equipment, airfinishing booths, pressure regulators, airconditioners for compressed air lines, air dusters and stripers.

MORRISON Metal Stitching decreases assembly time by 70% at CONVAIR

Flight photo of B-24 Consolidated Vultee Liberator

Another big manufacturer—Consolidated Vultee Aircraft Corporation—finds that Morrison Aircraft Metal Stitching saves precious manhours in assembling parts. Note they say the savings amount to *70% on many parts.*

If *you* are riveting or spot welding Aluminum, Stainless Steel, Plastics, Cork, Rubber, Asbestos, Wood, or Canvas, it will pay you to investigate Morrison Aircraft Metal Stitchers. Machines are available for immediate shipment. Write for Bulletin No. 3-A.

CONSOLIDATED VULTEE AIRCRAFT CORPORATION

VULTEE FIELD DIVISION
VULTEE FIELD, CALIFORNIA

Omaha Public Library
Reference Dept.

December 15, 1943

Mr. W. B. Reich
Harry W. Brintnall Company
746 E. 17th Street
Los Angeles, California

Dear Mr. Reich:

Attached are several pictures showing the use of the Morrison Aircraft Metal Stitching Machine at the Vultee Field Division.

Experience here has shown that Metal Stitching has decreased assembly time by approximately 70% on many parts.

The photographs illustrate the Stitcher in use on B-24 Bomber parts.

Sincerely yours,

CONSOLIDATED VULTEE AIRCRAFT CORPORATION
Vultee Field Division

Nelson Metcalf
Methods and Controls Manager

WRM:bg

Below: stitchir
duct at Vulte

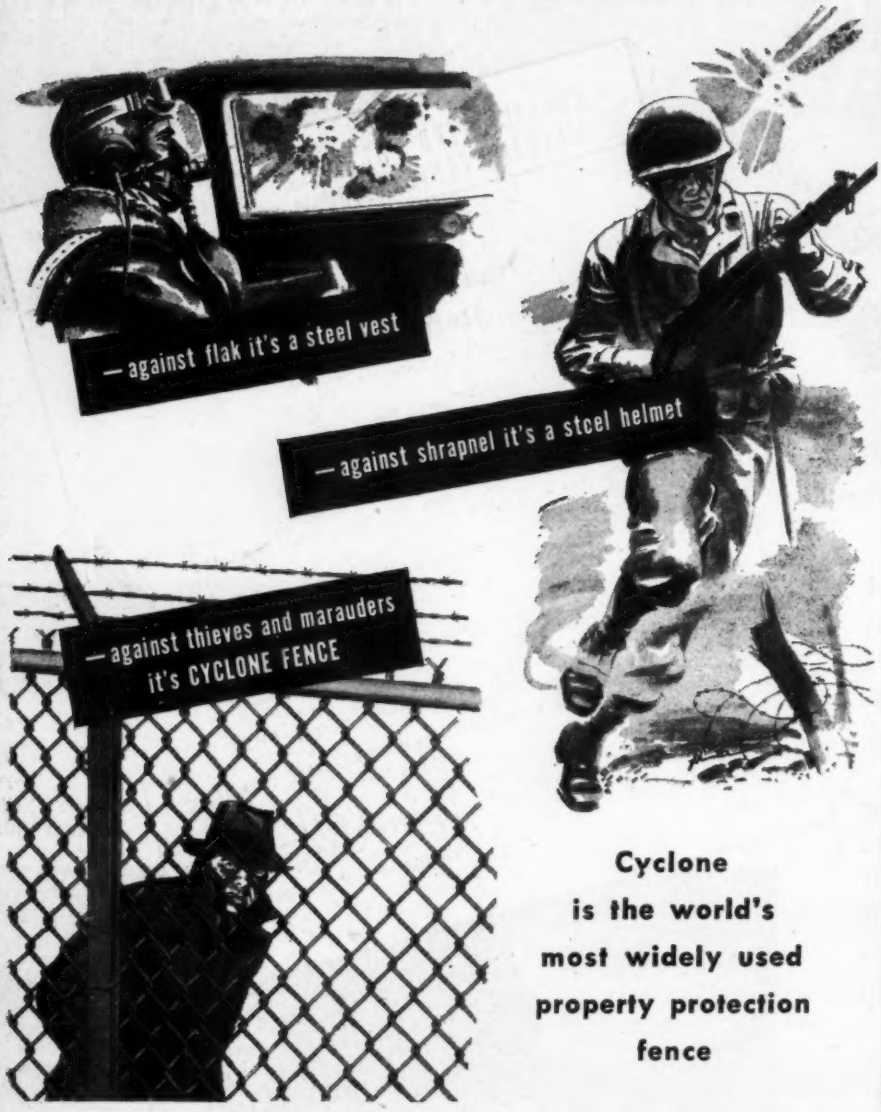
Another of the many parts being metal stitched.

MORRISON

PRODUCTS OF THE SEYBOLD DIVISION
HARRIS-SEYBOLD-POTTER COMPANY
DAYTON F7, OHIO

STITCHERS

TOPS IN PROTECTION



Cyclone is the world's most widely used property protection fence

WHETHER or not you are eligible for new fence while the war lasts—it's not too soon to think about your post-war needs. Send the coupon for our free 32-page book on Cyclone Fence. It shows 14 different kinds of fence—will help you choose the right type for your needs.

And write us about your requirements. We'll be glad to make advance recommendations and give you a free estimate. If you are making war goods and have the necessary priority, we can provide you with the Cyclone Fence and other wire safeguards you lack, now.

CYCLONE FENCE DIVISION (AMERICAN STEEL & WIRE COMPANY)
Waukegan, Ill. · *Branches in Principal Cities*
United States Steel Export Company, New York

CYCLONE FENCE

USS
UNITED STATES STEEL

Clip this coupon—and send it to:
Cyclone Fence, Waukegan, Ill., DEPT. 934
We'll send you our free, 32-page book on fence. It's full of facts, specifications, illustrations. Shows 14 types of fence. Before you choose any fence for your property, get the facts about Cyclone. Mail this coupon today.

Name.....
Address.....
City..... State.....
Interested in fencing: ☐ Industrial; ☐ School; ☐ Playground; ☐ Residence. Approximately.....feet.

FLOORS TAKE AN AWFUL BEATING!

WHIZ Heavy Duty Self-Polishing Floor Wax is a Tough, Long-Wearing, Water-Proof, Slip-Proof, Lustrous...

Floor Protection

For use on all types of floors. Spreads uniformly, dries in about 20 minutes. Leaves a tough, long-wearing, lustrous finish. Waterproof—takes damp moppings with a mild solution of soap and water. Used by leading institutions, industrial and commercial firms. *Write Industrial Division, R. M. Hollingshead Corporation, Camden, N. J., for name of nearest distributor.*

Powdered and Liquid Hand Soaps · Scrubbing Soaps · Cleaners · Floor Waxes · Odorless and Concentrated Insecticides · Furniture and Metal Polishes · Drain Pipe and Bowl Cleaner · Protective Hand Cream · Degreasing Compound · Hydraulic Fluids · Rust Preventives.

Hollingshead WHIZ
LEADER IN MAINTENANCE PRODUCTS

BUY MORE BONDS

LADISH

QUALITY FORGINGS

land with the first wave

The ships, tanks and planes that storm the beachheads... and the tractors and bulldozers that build advance bases on our newly won ground... carry Ladish Quality Forgings into the thick of the fight.

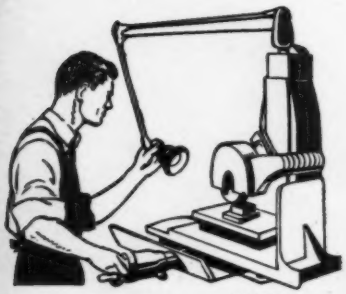
LADISH DROP FORGE CO.

CUDAHY • WISCONSIN

MILWAUKEE SUBURB

TO MARK PROGRESS

You are looking at the first and only *Floating* LAMP



MACHINE TOOLS

ASSEMBLY LINES

INSPECTION BENCHES

DRAFTING BOARDS

FLOATING is the only word to describe the effortless action of the Dazor Lamp. For a slight touch will *float* this light exactly where it's needed, as easily as a man can move his arm. And it *stays put* without locking. Raise, lower, push, pull or turn the Dazor *Floating* Lamp—it remains firmly and automatically held in position. Thus *localized* lighting acquires new efficiency . . . increasing production, improving accuracy and safety, lowering costs.

Each job presents a separate lighting problem of illuminating the working area. With the Dazor *Floating* Lamp an employee gets lighting *flexibility* at the point of work. He can control intensity . . . avoid reflected glare . . . curtail eye-strain, fatigue and error. A single spring force acting through an ingenious linkage and arm parallelogram balances the lamp arm in any desired position. Both Fluorescent and Incandescent Dazor Lamps are available; 4 bases cover every type of machine fastening and portable plant use.

In thousands of industrial and governmental operations, economical Dazor *Floating* Lamps are contributing to high productive capacity. They are distributed by electrical wholesalers, selected for ability to serve. Call your electrical wholesale supplier or write us for the names of our distributors in your locality. Upon request for Booklet "F" we will also send a 16-page Illustrated Catalog describing Dazor models, features, applications.

Dazor Manufacturing Co. • 4479 Duncan Ave., St. Louis 10, Mo.

DAZOR *Floating* LAMPS

FLUORESCENT *and* INCANDESCENT

YOU'RE SAVING WASTE PAPER ... BY THE POUND!

Now! Save paper waste ...by the mile!

A SERIOUS SHORTAGE IN PAPER USED FOR RECORDS AND COMMUNICATIONS THREATENS THE NERVE SYSTEM OF YOUR BUSINESS

LET'S ADMIT IT. It's more than a paper shortage you're facing today. It's a breakdown in the very *nerve system* of your business. For the flow of production in *every* war plant depends, from beginning to end, on vital written records . . . *on paper.*

Where is more fine paper for records coming from? Not from more wood pulp, already short. Not principally from salvaged *waste* paper. It can come mainly from only one place. From paper saved *instead* of wasted. From skillful designing of printed forms and systems of control that makes *less* paper do *more* work . . . that saves inches which multiply into *miles.*

STANDARD SPECIALISTS *will welcome an opportunity to study accounting and control systems in your plant and make suggestions which may not only simplify paperwork and conserve paper, but also save valuable time, energy, man power and equipment. There is no charge, of course. No obligation.*

HOW YOUR STANDARD SPECIALIST MAY HELP YOU SAVE PAPER BY THE MILE

1. 7.1 miles of paper were saved in a typical instance (on the usage of 25,000 sets of forms annually), by skillful reduction from 8½ x 8½ to 8½ x 6½ size through Standard Formcraft engineering.

2. 6.6 miles of paper saved is not unusual (annual usage of 50,000 forms) where two forms are combined for one-time writing.

3. 3.4 miles of paper represents a saving made when analysis of three related records showed that one could be eliminated.

Standard is the originator, in continuous business forms, of these distinctive marginally punched holes which are Marks of Identity of the continuous forms of The Standard Register Company—"the Forms with the Punch."

The STANDARD REGISTER Company
DAYTON 1, OHIO

Pacific Coast: Sunset McKee-Standard Register Sales Co., Oakland, California.
Canada: Crain Printers, Ltd., Ottawa. London: W. H. Smith & Son, Ltd.

SEND FOR FREE CHART MAIL COUPON TODAY

THE STANDARD REGISTER COMPANY
201 Albany St., Dayton 1, Ohio

Send your FREE CHART showing the "nerve system" of industry and how to "save paper by the mile"... in 61 places.

NAME _____ TITLE _____

FIRM _____

ADDRESS _____

When "Camouflage wool" comes back to the kitchen

...in its old familiar form!

YOU remember these little pads of steel wool that kept frying pans shining. You wouldn't recognize them in battle dress. Used as permanent weather-proof "foliage" to camouflage gun emplacements and to screen machine gun nests from the wily Jap, steel wool has seen plenty of service with Uncle Sam's forces.

Neither would you recognize the thousand other sorely missed steel wire products — wire coat hangers, window screening, poultry netting, mattress and furniture springs, bobby pins and paper clips—that, like steel wool, are now doing duty in the form of fighting equipment. But it is well to remember that this steel wire which now goes into submarine nets, machine gun springs, barbed wire entanglements and fragmentation bombs will be back from the battle fronts in the not too distant future.

Then, the things we have learned in these war years about making steel wire better—how to turn it out faster, in greater quantities, and from new and better steels—will be ready to give you steel wire for manufacturing that is superior, both in quality and performance.

Let us work with you—

After the war, America expects better products . . . from YOU. Better in appearance, in efficiency, in durability. And reasonable in cost. Our metallurgical engineers and wire-making experts are ready *now* to help you meet this challenge. They will work shoulder-to-shoulder with you in fitting steel wire and steel wire products to give your peace-time product benefits and advantages hitherto undreamed of. Call on us.

ONE AIM . . . **VICTORY**

BUY WAR BONDS

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco — United States Steel Export Company, New York

USS

AMERICAN *Quality* **MANUFACTURERS WIRES**

UNITED STATES STEEL

Designing Molded Plastics Parts: ASSEMBLY METHODS

From the engineering files of One Plastics Avenue

There are a number of methods by which plastic parts may be joined together or assembled with other materials. However, few standards exist for such design, most methods being selected to suit a specific problem. To insure satisfactory performance in finished assemblies, consider the following general design points:

1. Allow for thermal expansion and aging characteristics when designing rigid mounting between plastic and dissimilar materials.
2. Threaded inserts are recommended where frequent disassembly is anticipated. They likewise allow for adjustment of assembly and provide good strength.
3. Special devices well adapted to plastic assemblies include speed clips, self-tapping screws, drive screws, spring hinges, and spun-over rivet-type inserts.
4. Most thermosetting plastics may be cemented together to form a reliable seal. Pressure bonding and bake may be required.
5. Thermoplastics can usually be cold-joined with a solvent such as acetone. Thermoplastic seals may be made over a lug or rim by hot-forming.
6. Integral threads constitute a good method of assembly. Consideration should be given to economies of molding thread versus machining after molding.

BODY INSERTS

Inserts with male or female threads may be incorporated in molded parts to provide a positive means of assembly.

Metal parts may be fastened to rivet-type inserts by spinning down the rivet head. Tubular inserts may be inserted in molded holes subsequent to molding to provide a similar assembly.

Inserts to carry assembly load should provide shoulder protruding above face of plastic to retain stress on metal components.

SELF-TAPPING SCREWS—DRIVE SCREWS

Self-tapping screws may be used for economy when moderate strength and infrequent disassembly is expected.

Drive screws may be used for long holes and permanent assembly.

Holes for either of above may be molded or drilled.

MOLDED THREADS—TAPPED THREADS

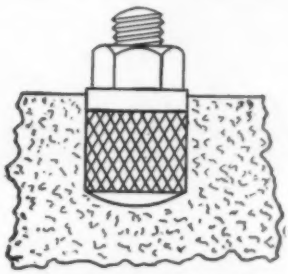
Two or more plastic parts may be assembled with molded threads. Avoid designs requiring long engagement of plastic threads to metal threads since shrinkage of plastic may shorten pitch of molded thread.

Tapped threads may be satisfactory for units requiring infrequent disassembly. In general, avoid tapped threads of greater than ¼ in. diameter and give consideration to the particular type of plastic involved, as some plastics are better adapted to machining or service requirements than others.

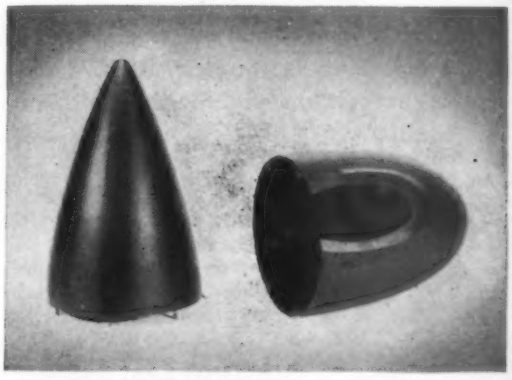
HINGES AND CLIPS

Stamped metal parts may be used for hinges, knobs, or handles. Metal hinges may be attached to plastics with screws or inserted into properly designed recesses in molded parts. Hinges may also be molded as integral part of plastic piece.

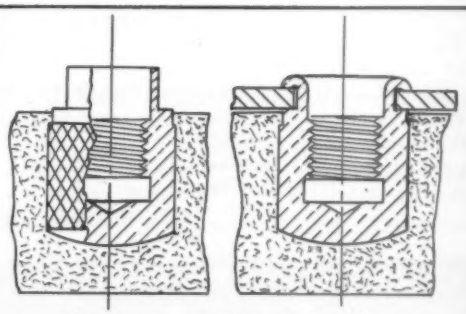
Speed clips are available for economical assembly, usually permanent. They frequently provide locking for vibration-proof qualities.



Protruding shoulder of insert avoids assembly stress on adjacent plastic.



TYPICAL APPLICATION—In this unfinished molded housing two large sections are joined with threaded studs and hex nuts, and then sanded. Studs and assembly lugs molded in part insure tight fit and easy assembly.



Permanent assembly achieved from spinning over tubular insert

REPRINTS of this advertisement may be obtained by writing Section H-226, General Electric Plastics Divisions, One Plastics Avenue, Pittsfield, Mass.

Hear the General Electric radio programs: "The G-E All-girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news, every weekday 6:45 P.M. EWT, CBS

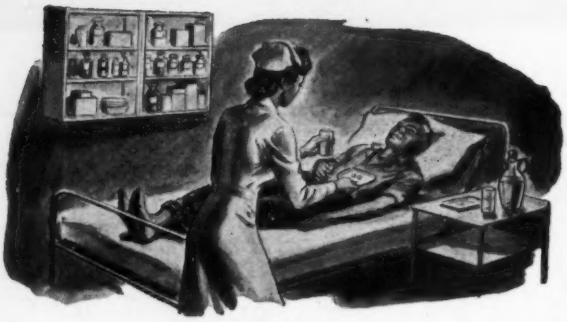
BUY WAR BONDS

PD-226

GENERAL ELECTRIC

PLANT MANAGERS!

Cut Loss of Manhours due to Heat Sickness!



MAN-HOURS—that vital combination of labor and time—usually suffers a sharp decline in summer due to heat sickness!

But Sterling Salt Tablets can eliminate heat sickness in your plant! For this industrial hazard is caused by loss of salt in the human system due to excessive perspiration.

Yet the remedy is simplicity itself. When your workers replace that salt loss with Sterling Salt Tablets, heat sickness vanishes!

SALTY SAYS:

GET FREE SAFETY POSTER! To eliminate heat sickness in your plant . . . put a Sterling Salt poster to work! Its simple message warns workers . . . tells how Sterling Salt Tablets protect them from heat sickness.

★

STERLING SALT TABLETS of purest, compressed granulated salt.

Quantity	*Size*	*Price*
Case 6/1500's	10-grain	$2.60
Case 24/500's	10 grain	3.50

EXTRA ENERGY SALT AND DEXTROSE TABLETS

Case 6/1500's	9-grain	$3.05

STERLING TABLET DISPENSERS—durable plastic housing; one-at-a-time supply feature.

500-Tablet size	$3.25
1000-Tablet size	4.00

All prices include delivery.

Let's all Back the Attack
BUY MORE WAR BONDS

Sterling
SALT TABLETS
INTERNATIONAL SALT COMPANY, INC.
SCRANTON, PA.

HOW MANY CARBIDE BITS WILL A *SUPER-CUT* DIAMOND WHEEL GRIND?

• Frankly, we don't know. One case is reported where a single Super-Cut Diamond Wheel, operating under careful supervision, ground over 22,000 carbide chip breaker tools of various sizes. And cases of ten to fifteen thousand carbide tools ground with one and the same Super-Cut Wheel are common.

We DO know that Super-Cut Diamond Wheels will speedily *and materially* lower your grinding costs to the minimum! We'll gladly prove this to your satisfaction in your plant on your work!

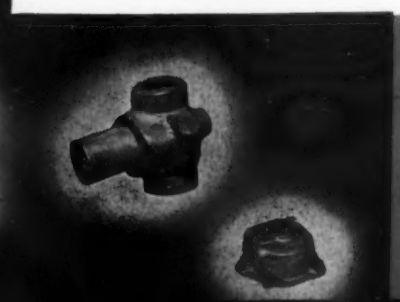
Super-Cut Diamond Wheels are bonded by a closely guarded, secret process used exclusively by Industrial Abrasives, Inc. The cutting section of each Super-Cut Wheel is comprised of layer upon layer of evenly distributed diamonds, each firmly imbedded in metal. As one layer slowly wears away another non-glazing cutting surface is exposed.

For faster, finer grinding and finishing, specify Super-Cut Diamond Wheels, now available for immediate delivery. Full particulars will be sent at once if you address—

Industrial Abrasives INC.

3724 West 38th Street Dept. 3-G Chicago 32, Ill.

If you can't get BRASS or BRONZE...



EATON PERMANENT MOLD IRON CASTINGS offer you 4 Big Advantages!

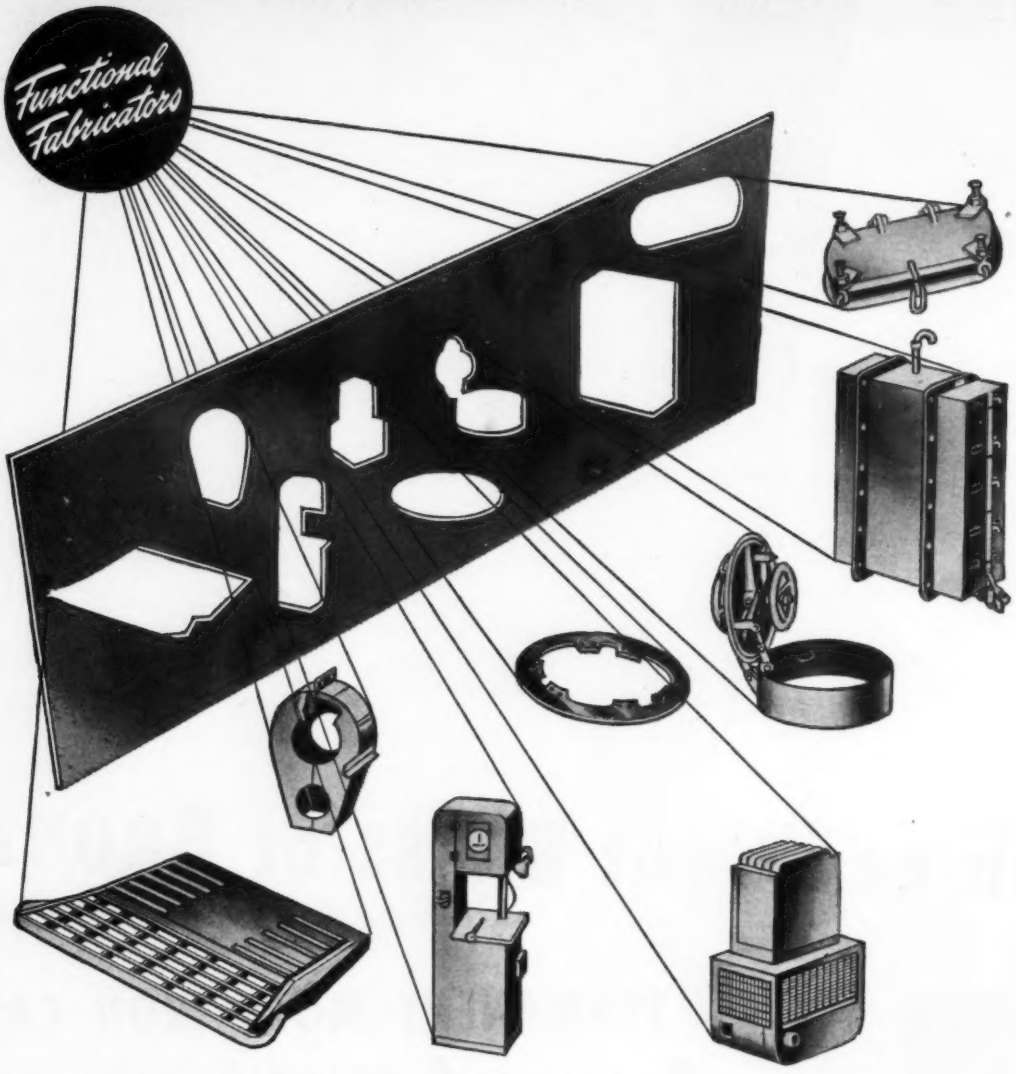
For many years Eaton has been making Permanent Mold Iron castings on a volume scale, to manufacturers' own specifications, by a patented machine method which offers you these *four* important advantages:

1. **PERMANENT MOLD IRON has a fine-grained homogeneous structure—a factor that makes it absolutely free of porosity.**
2. **PERMANENT MOLD IRON compares favorably with Brass and Bronze in machinability, can be worked with little change in present machine tool setup.**
3. **PERMANENT MOLD IRON is a lower base cost material.**
4. **PERMANENT MOLD IRON CASTINGS can be produced in complex, cored designs or simple shapes with accuracy and uniformity, by this patented EATON PERMANENT MOLD PROCESS.**

Let us give you the whole *convincing* story.

EATON

EATON MANUFACTURING COMPANY
Foundry Division
9771 FRENCH ROAD • DETROIT, MICHIGAN



To Manufacturers Not Tooled-Up For Sheet Metal Fabrication

The best guess on the new steels, white metals, plastics, and plywoods is that they will be used in combinations rather than instead of each other.

Few factories can afford to tool-up for working them all into products now or post-war.

As a manufacturer whose total sales have passed well beyond the $100,000,000.00 mark, we have found that certain parts of the many steel products we manufacture can be made in other factories more economically than were we to tool-up for it.

On the other hand we have demonstrated to a number of other manufacturers that we can produce the sheet metal parts for their products speedily, better and more economically. Even before wartime no small portion of our facilities was devoted to functional fabrication for other manufacturers.

The Butler organization can place at your service:

43 years of know-how.
High aptitude engineering.
Skilled metal crafters.
Three great factories.
Hundreds of sheet metal working machines.
Line production methods.

If you are interested in the plus value and minus costs this affords, send your specifications to Butler Engineers at our Kansas City factory, 1221 Eastern Ave.

Awarded Kansas City Plant

BUTLER MANUFACTURING COMPANY
KANSAS CITY 3, MO.
GALESBURG, ILL. MINNEAPOLIS 14, MINN.
Sales Offices—Washington, Chicago, Atlanta, Shreveport

PRODUCING FOR WAR... PLANNING FOR PEACE

BUTLER BUILT

☆ ☆ ☆ STEEL PRODUCTS ☆ ☆ ☆

STEEL BUILDINGS . . . TANKS (Storage, Processing and Transport) . . . FILTERS . . . STILLS . . . DRY CLEANING EQUIPMENT
RURAL GAS SYSTEMS . . . SEPTIC TANKS . . . GRAIN BINS . . . FARM EQUIPMENT and PRODUCTS OF OTHER METALS

GRATON AND KNIGHT

ONLY "RESEARCH" BELT GIVES YOU THIS

"DOUBLE-PLUS"

THE 3 BIG ADVANTAGES OF QUALITY LEATHER

MORE PRODUCTION, because leather's superior traction improves with age, means more power delivered . . . greater average machine production.

LESS MAINTENANCE, because leather has natural "give and take" to handle shock loads without undue strain on belt or equipment.

LONGER LIFE, because the tough, interlocking fibres of leather have high resistance to both surface wear and internal friction.

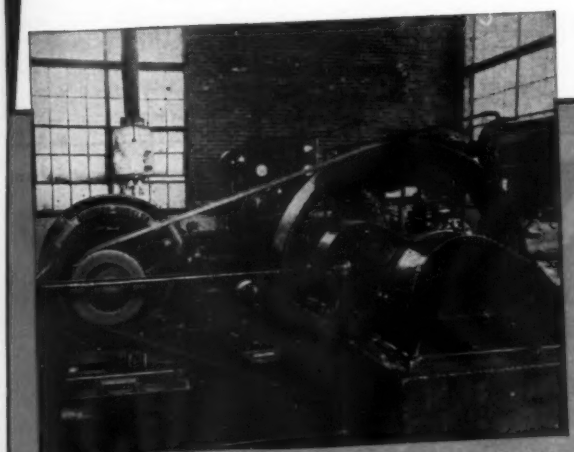
and

3 EXCLUSIVE FEATURES OF "RESEARCH" BELTING

MOST PRODUCTION, because "Research" currying added to leather's superior traction creates highest frictional surface. 3% more production guaranteed.

LEAST MAINTENANCE, because G&K'S pre-stretching process removes non-elastic stretch, resulting in fewer take-ups. Tensile strength is also increased 15%.

LONGEST LIFE, because precise weight-controlled lubrication of fibres develops extremely long life. "Tension-Cementing" insures against ply separation.



HERE'S A TYPICAL EXAMPLE OF

LEAST MAINTENANCE

WITH "RESEARCH" ON YOUR DRIVES

These "Research" Belts, installed June 1940, have required no maintenance — not even shortening. Drive data: 100 KVA synchronous motor, 900 R.P.M. — mounted on No. 14-I Rockwood pivoted motor base . . . 17½" diameter motor pulley . . , 72" compressor pulley . . . 78" center distance . . . bottom pull . . . 14" G&K Research Double, 25½' long. 12" motor pulley, belted by 4" G&K Research Double, 10' 11" long, drives exciter with 7½" pulley mounted on No. 6 Rockwood base . . . 50" center distance.

"Research" Belts come to you pre-stretched to save you the trouble and cost of frequent take-ups. Pre-stretching by an exclusive method — according to hide characteristics.

GET AT LEAST 3% MORE PRODUCTION ...2 TO 4 TIMES LONGER LIFE ON LONG OR SHORT CENTERS...by specifying "Research" the Belt with the ++

Graton & Knight is the only leather belting manufacturer with complete nation-wide service facilities. Branches in Chicago, Cleveland, Dallas, Detroit, Kansas City, Minneapolis, New York, Philadelphia, St. Louis, San Francisco; distributors in all industrial centers.

Look under "Graton & Knight" in Belting section of Classified Telephone Directory or THOMAS' REGISTER.

GRATON & KNIGHT COMPANY

WORCESTER 4, GRATON AND KNIGHT MASS.

EASY WAY TO TREAT WASH WATER in paint spray booths

HERE IS A TIP for maintenance men and paint spray department foremen that will help prevent paint pigment adhering to the sides and stacks of paint spray booths . . . make reclamation of paint EASIER.

JUST treat solution of your recirculating system with one of the several recommended Oakite materials specially designed for this purpose. You'll find they not only keep paint particles non-adhesive, but also prevent pump or water system from becoming clogged and accumulations from forming on exhaust and other equipment. In addition, Oakite materials assist in floating or sinking paint particles so that they may be quickly skimmed off or shoveled out of tank.

TECHNICAL SERVICE FREE!

Write us TODAY and our Technical Service Representative will call and give you the benefit of his wide experience in this work. There's no obligation, of course.

OAKITE PRODUCTS, INC.
14A Thames Street, New York 6, N. Y.

Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE *Specialized cleaning*

Buy Bonds for Victory

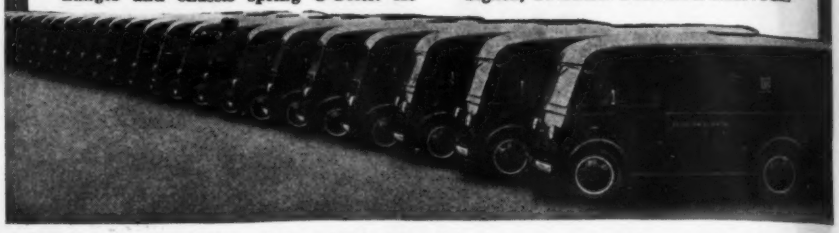
MATERIALS & METHODS FOR EVERY CLEANING REQUIREMENT

SIX MONTHS' TEST PROVES
Boots Nuts Eliminate Periodic Tightening

"The sample Boots Nuts which you supplied have now been in use on several of our vehicles, both light and heavy, for a period of six months.

We selected two difficult spots for their application, drive shaft universal joint flanges and chassis spring U-bolts. At these points plain nuts are not satisfactory unless a lock washer or jamb nut is used to hold them. Even so, they require periodic tightening.

The Boots Nuts in use have not required any attention since they were installed."
Signed, UNITED PARCEL SERVICE



A portion of the 2900-truck fleet of United Parcel Service trucks serving 16 metropolitan cities

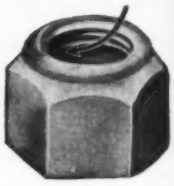
THIS report of a test made by the country's outstanding consolidated delivery company, operating in sixteen cities, is a clear-cut indication of the economies that Boots All-Metal, Self-Locking Nuts will effect in the transportation field after victory.

One piece, all-metal, Boots withstand the corrosive action of oil, water and chemicals. There's nothing to dry out, crack or shrink. Also, Boots Self-Locking Nuts can be used over and over without accelerated locking loss.

BOOTS SELF-LOCKING NUTS
"There's No Excuse for a Nut Shaking Loose"

Boots Aircraft Nut Corp. • General Offices, New Canaan, Conn.

The ALL-METAL lock is built in here



ROL-TOP. This style nut, now used on all types of aircraft engines, is the type of Boots All-Metal, Self-Locking Nut mentioned in the above letter.

JOHNSON *High Carbon Wire*

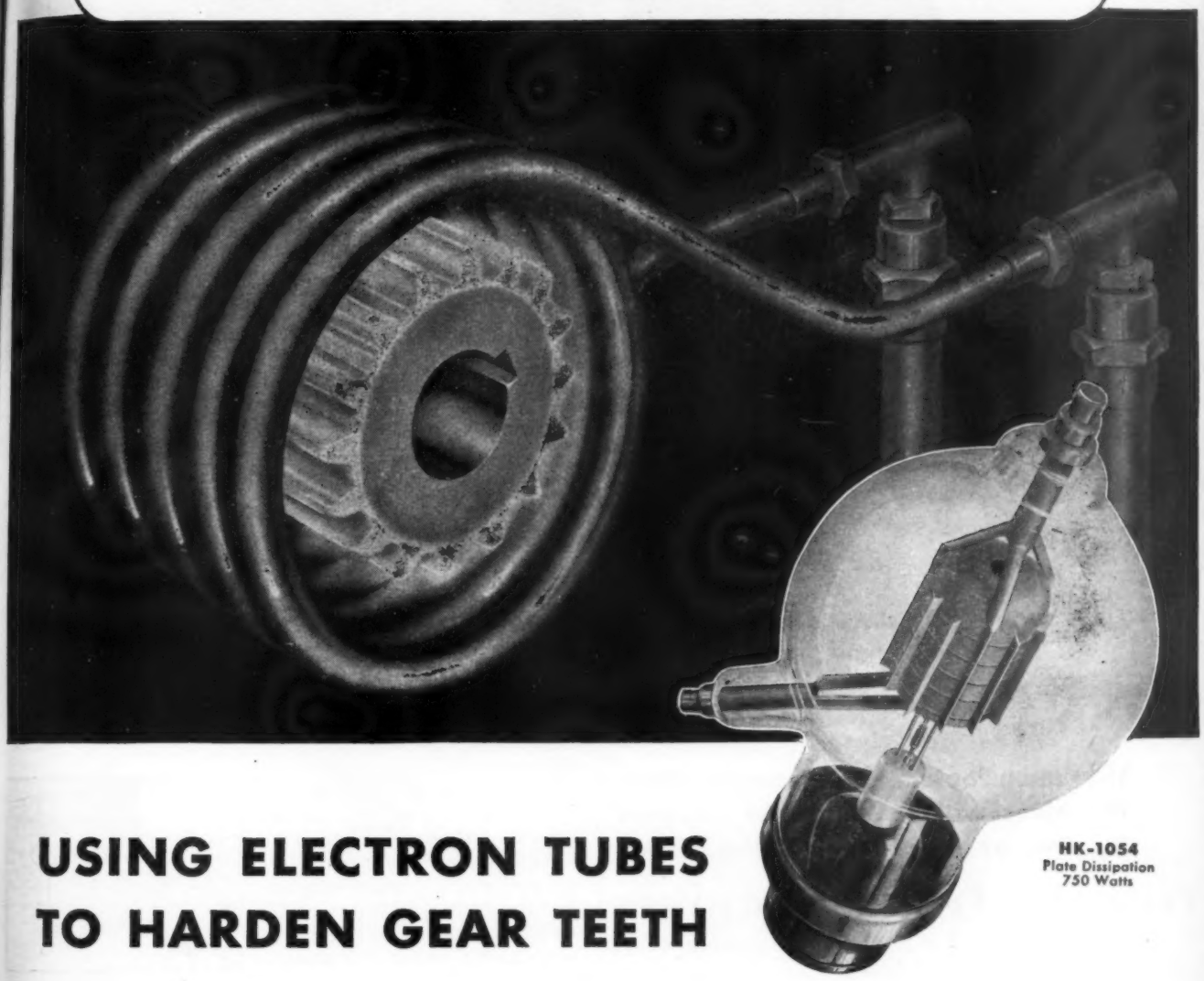
Shapes
Round — Half Round — Oval — Square — Flat
Triangular and Special Shapes

Finishes
Bright-Coppered — Liquor Finish — Bronze Plated
Tinned — Cadmium — Bright Galvanized
Oil Tempered Round — Flat and Shaped Wires

JOHNSON STEEL & WIRE CO., INC.
WORCESTER 1, MASSACHUSETTS.
NEW YORK ATLANTA AKRON CHICAGO LOS ANGELES

Your future is linked with the

ERA OF ELECTRONICS



USING ELECTRON TUBES TO HARDEN GEAR TEETH

HK-1054
Plate Dissipation
750 Watts

Through the use of vacuum tubes the time required to surface harden gear teeth has been reduced from hours to as little as 15 to 20 seconds. A magnetic field is set up within the surface of the metal, and heat is induced by an oscillator which rapidly reverses the polarity of the field.

This heat is generated in the surface of the metal, and its depth is determined by the frequency. High frequencies are required where a very thin case is desired —less than 1/16 of an inch—or where it is necessary to conform to sharp contours.

Electronic heating is extremely accurate and simple. The operator places the part within the heater coil, presses a button, and the part is heated and quenched with split-second accuracy and absolute uniformity.

Electron tubes are being used not only for surface hardening but to speed up processes involving annealing, brazing, and soldering of a great variety of metals.

When installing electronic heating equipment after the war, make sure it is powered by Gammatron tubes . . . for 15 years the leaders in efficient high frequency power output.

HEINTZ AND KAUFMAN LTD.
SOUTH SAN FRANCISCO • CALIFORNIA

Gammatron Tubes

Gammatron tubes are built for exceptional long life—some have endured 32,000 hours of continuous service. They are constructed with tantalum elements and without internal insulators in order to handle heavy overloads without failing. Their unique design results in remarkable efficiency at up to 150,000,000 cycles a second.

FOR VICTORY AND SECURITY BUY WAR BONDS

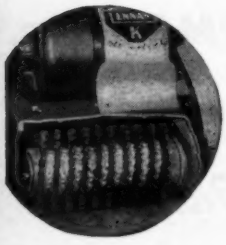
Soon...

the manufacture of Tennant Floor Machines will no longer be eclipsed by the production of Gun Sights

TENNANT FLOOR MACHINES

Perform an important War Service in maintaining SAFE, Clean Floors in war factories, mills and offices throughout the nation. Clean floors help to reduce accidents, speed production and facilitate the movement of materials through the plant.

The service of Tennant field representatives is available without cost. If you have floor cleaning and maintenance problems *now* or want to make *plans for the future,* write or wire today.



Tennant Model K

loosens and picks up imbedded dirt, grime and metal cuttings by the exclusive Tennant *dry* cleaning method.

G. H. TENNANT CO. Established 1870

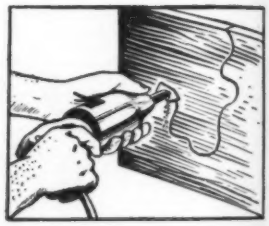
2554 North 2nd St. Minneapolis, Minn.

Pioneers in modern floor maintenance

TENNANT SYSTEM OF INDUSTRIAL FLOOR MAINTENANCE

New Saw-Gun Saws and Files in Hard-to-Get-At Places

Jobs of sawing and cutting that are inaccessible to ordinary tools, are now made possible with the recently developed Saw-Gun. It works equally well on wood, plastics, light and heavy gauge metals (corrugated or plain—stainless and monel), castings, rods and other materials. The Saw-Gun saves hours on panel notching and slotting operations, doing work ordinarily requiring the use of several tools.

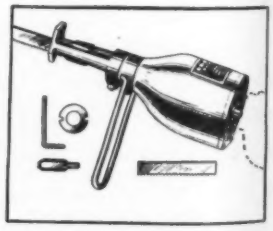


Permits sawing and filing in spots inaccessible to ordinary tools.

It is propelled by electric power, compressed air or flexible shaft and provides an efficient portable power-saw or file, that can be carried from place to place.

The Saw-Gun is operated by placing cutting edge of saw blade against work and turning on power. Filing is accomplished in the same manner by inserting a file in the tool instead of a saw blade.

We hope this has proved interesting and useful to you, just as Wrigley's Spearmint Gum is proving useful to millions of people (much to their surprise) working everywhere for Victory.

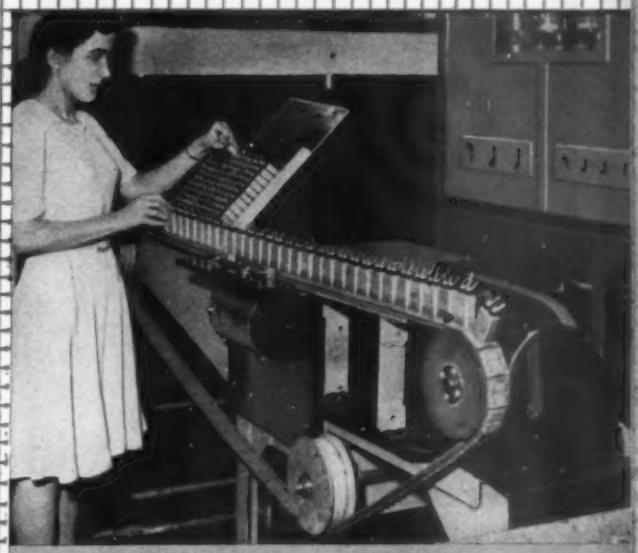


Can be directly connected to electric drill, air drill, or flexible shaft.

You can get complete information from the Mid-States Equipment Company, 2429 S. Michigan Ave., Chicago 16, Ill.

V-106

HOW AN RCA ELECTRON TUBE DOES ONE SOLDERING JOB 25 TIMES FASTER



This is the RCA electronic device that speeded up our radio condenser production by 2400%! It is powered with four RCA 833-A Power Triodes and six RCA 872-A Rectifier tubes.

BUY MORE WAR BONDS

THINK what it would mean to be able to turn a production-line soldering job over to a tube... a tube that didn't tire, but did its work more quickly, more accurately, and with less solder waste than even the most expert solderer could possibly do manually.

While it isn't possible to do *every* soldering job electronically today, enough practical applications already exist to make it well worth your while investigating.

We did, at RCA, and here's one example of how it paid out:

Among the many things we make are oil-filled radio condensers. Their metal lids must be soldered in place to provide sealed oil-tight units. We used to have to do this by hand, using a gas flame for heating. Production was at the rate of 100 condensers an hour. But now a conveyor belt passes the condensers between two inductors in which current from a radio-frequency generator, powered by RCA electron tubes, is flowing ...and the soldering is done automatically and *very much faster*. With 4 kilowatts of r-f power, the conveyor belt can now deliver 2500 condensers per hour, or about one every 1½ seconds!

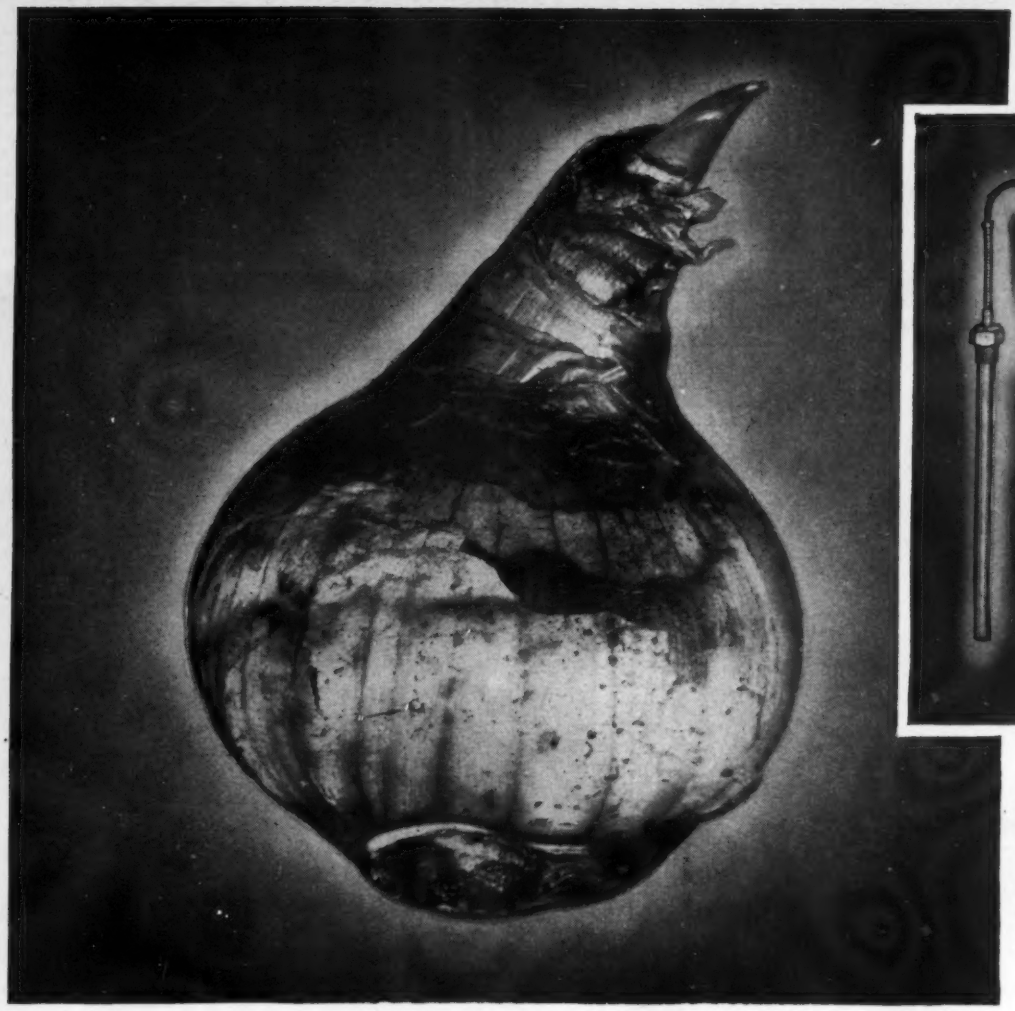
If you need to pre-heat wood or plastics for molding, or case-harden, anneal, or join metals, bake paint, tack plywood, seam thermoplastic fabrics, dry textiles, or solder parts or assemblies on a production line, it may be that electronic heating can produce for you a superior product, and a substantial saving in time.

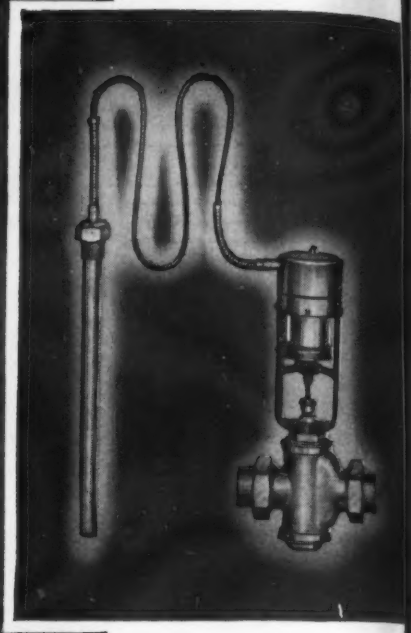
RCA has a wide range of tubes for these and many other industrial uses. Our engineers will gladly share with you the tube "know how" that makes their application practical today. *For the Magic Brain of all electronic equipment is a tube, and the fountain-head of modern tube development is RCA.*

May we mail you our illustrated booklet *Electrons in Action at RCA?* Write Room 480, RCA-Victor Division, RADIO CORPORATION OF AMERICA, Camden, New Jersey.

RCA

RADIO CORPORATION OF AMERICA





No. 923 Temperature Regulator for Controlling Temperatures of Liquids. One of many models available. Why not investigate the advantages of these regulators as applied to your own control problems?

CONCERNING BUGS AND BULBS

SOME YEARS AGO, a large shipment of Narcissus bulbs from Holland created a truly difficult temperature-control problem.

The U. S. Department of Agriculture objected strenuously to the importation of bugs, while American growers were just as energetic in their efforts to *get* these Dutch Narcissus bulbs. Fulton Sylphon Engineers took over the difficult job of killing the bugs without killing the bulbs.

The problem was licked by accurately controlling the temperature of hot water in a "sterilizer" to within less than one degree plus or minus. The bugs were duly made quite dead and the bulbs lived to bring beauty to gardens throughout America.

For over 40 years, Fulton Sylphon control devices have been solving problems involving accurate temperature control of liquids and gases. Would you like to have literature illustrating and describing a number of these regulators? Ask for Bulletin EF-20.

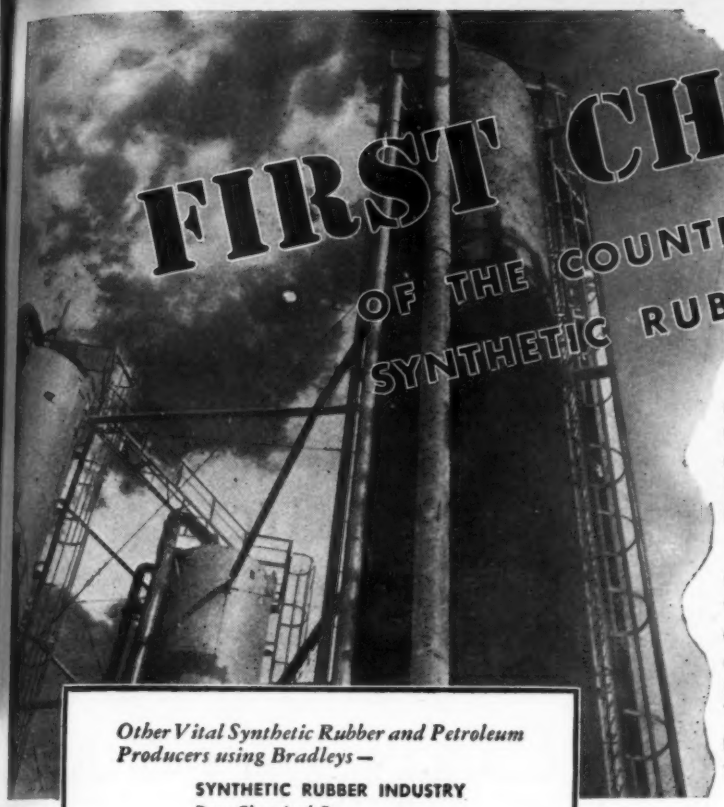
TEMPERATURE CONTROLS..

FULTON SYLPHON

BELLOWS... BELLOWS ASSEMBLIES SINCE 1904

THE FULTON SYLPHON CO., KNOXVILLE 4, TENNESSEE

Canadian Representatives, Darling Bros., Montreal



FIRST CHOICE OF THE COUNTRY'S VITAL SYNTHETIC RUBBER INDUSTRIES

● Again, at the modern Synthetic Rubber Plant at Baton Rouge, there was little question about the type of employee wash and shower facilities. Selection of the very finest equipment throughout included 8 Bradley Washfountains and 26 Multi-Stall Showers—facilities well in keeping with the entire project.

Each Washfountain serves 8 to 10 persons simultaneously—each person supplied with clean running water from the central sprayhead and the used water drained off via the deep, self-flushing bowl. Bradleys cut water consumption by 70 per cent and reduce piping connections and installation time, because each Washfountain and its *one set* of piping connections takes the place of 8 to 10 conventional "single-person" wash basins with their multiplicity of piping.

Bradley Multi-Stall Showers offer similar advantages. Coming partially assembled, they speed installation, too. More and more, industry is recognizing the value of shower baths in improving health, efficiency and morale.

Add to your present washing facilities, modernize outmoded, inadequate washrooms now. Write for complete new Catalog 4308. BRADLEY WASHFOUNTAIN CO., 2215 W. Michigan Street, Milwaukee 1, Wis.

Other Vital Synthetic Rubber and Petroleum Producers using Bradleys—

SYNTHETIC RUBBER INDUSTRY

Dow Chemical Co.
E. I. duPont deNemours Co.
Firestone Tire & Rubber Co.
General Rubber Co.
B. F. Goodrich Co.
Goodyear Tire & Rubber Co.
Hycar Chemical Corp.
Paracord Rubber Mill
Port Neches Rubber Plant
Seiberling Rubber Co.
Synthetic Rubber Plant, Inc.

PETROLEUM COMPANIES

Atlantic Refining Co.
Cities Service Oil Co.
Kendall Refining Co.
National Oil Products Co.
Pennzoil Co.
Phillips Petroleum Co.
The Pure Oil Co.
Quaker States Oil Co.
Shell Oil Co.
Sinclair Refining Co.
Standard Oil Co.
The Texas Oil Co.
TideWater Oil Co.

BRADLEY *washfountains* AND *multi-stall showers*

PROTECT EQUIPMENT *with* GENERAL ELECTRIC FUSES

THESE are the same fuses General Electric uses to protect its own equipment. They provide reliable overload and short circuit protection. They are made of the finest materials and are thoroughly tested and accurately rated.

G-E Nonrenewable Enclosed Fuses 3-600 Amp., 250V. or 600V. Both indicating and nonindicating types are available.

G-E Renewable Enclosed Fuses 3-600 Amp., 250V. or 600V. Fiber bar supports link, provides proper alignment of terminals, facilitates replacement.

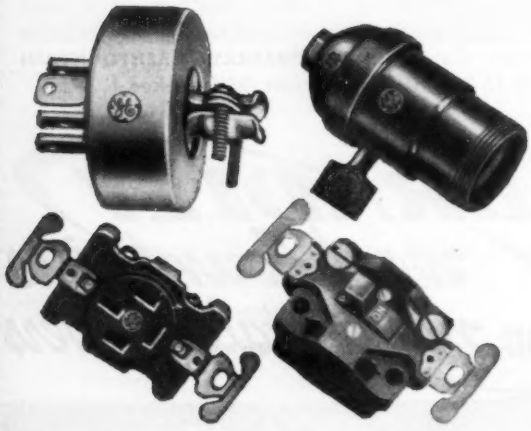
G-E Silvend Fuses with silver-plated contacts 3-600 Amp., 250V. or 600V. Designed for use with apparatus having silver-plated fuse contacts. Heating due to oxidation does not occur with this combination.

You'll find fuses of the correct type and proper rating for your requirements in the G-E fuse line . . . fuses that will assure adequate protection for your equipment.

Hear the General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news every weekday, 6:45 P.M. EWT, CBS.

BUY WAR BONDS

INDUSTRIAL WIRING DEVICES

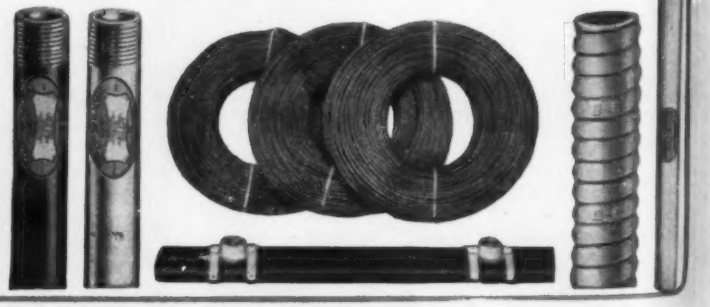


G-E wiring devices are available for all kinds of war-project wiring needs — for maintenance, rewiring or new wiring. The G-E line includes switches, outlets, lampholders, twist-lock devices, connectors, connector bodies, caps, fuses, fluorescent lampholders and starters, etc. These devices are high quality and will give long service.

FOR FURTHER INFORMATION about G-E fuses, industrial wiring devices, conduits or wires and cables, see the nearest G-E Merchandise Distributor or write to Section CDW-345-37, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

G-E CONDUITS AND BUILDING WIRES

G-E conduits and building wires will meet every requirement. In the G-E line are White and Black rigid conduits, EMT, flexible conduit, Fiberduct and various building wires including Type SN small diameter thermoplastic-insulated wire.



GENERAL ELECTRIC

144 Deming Pumps
IN THIS ONE PLANT!

A Deming Pump for Every Pumping Need!

A midwestern steel plant is almost a "living catalog" of Deming Industrial Pumps which are used exclusively for the wide diversity of pumping services involved in the company's operations.

Partial List of Services Performed by Deming Pumps

Cooling Tower service is performed by a battery of high head and low head Deming Centrifugal Pumps.

Slag Breaking is the job of Deming Slurry Pumps which pump cold water on hot slag to shatter it into small particles.

Descaling Billets as they roll from the mills is accomplished by cool water pumped by Deming Turbine Pumps.

Oil Pumping. Fuel oil is pumped from tank cars to storage tanks by Deming Power Rotary Force Pumps. Deming High Pressure Power Pumps force oil thru pipe lines to melt shop and oil-fired furnaces.

Dewatering. Deming Cellar Drainers and Sump Pumps remove waste water and oil which settle in low spots.

Spray Pool service (as illustrated in the above photograph) is handled by a battery of Deming Double Suction Centrifugal Pumps.

Saw Cooling. Deming Centrifugal Pumps supply water to the teeth of steel-cutting saws which require constant cooling while in use.

Many Other Services are performed by a variety of other Deming Pumps in this plant which uses Deming Pumps exclusively.

When YOU have a Pumping Problem — CALL DEMING!

DEMING
THE COMPLETE LINE
PUMPS AND WATER SYSTEMS
The Deming Company • Salem, Ohio

Here Comes the Hot Coffee!

Welcome! You can say that again

There just is no other way to service hot coffee to your workers indoors, outdoors, day shift or night shift, that will match the low cost efficiency of hot coffee service with "AerVoiD" Vacuum Insulated Coffee Carriers.

And is hot coffee appreciated by factory workers? You wouldn't ask the question if you had ever tried it. Just stop and reflect that it takes 91,300,000,000 cups of coffee per year, according to official figures, to satisfy America's coffee-craving, and you have the answer. No other beverage can point to such a pronounced public preference.

No, the "pin-up" girl in our plant is not Betty Grable, not Rosalind Russell, not Deanna Durbin, but the girl in the immaculate white uniform that shows up mid-morning and mid-afternoon with a delicious cup of hot coffee for everybody . . . office and shop. Hundreds of industrial War plants already have "AerVoiD" hot coffee service combating fatigue-lag in their workers. Cold days emphasize the need for this low-cost morale-builder.

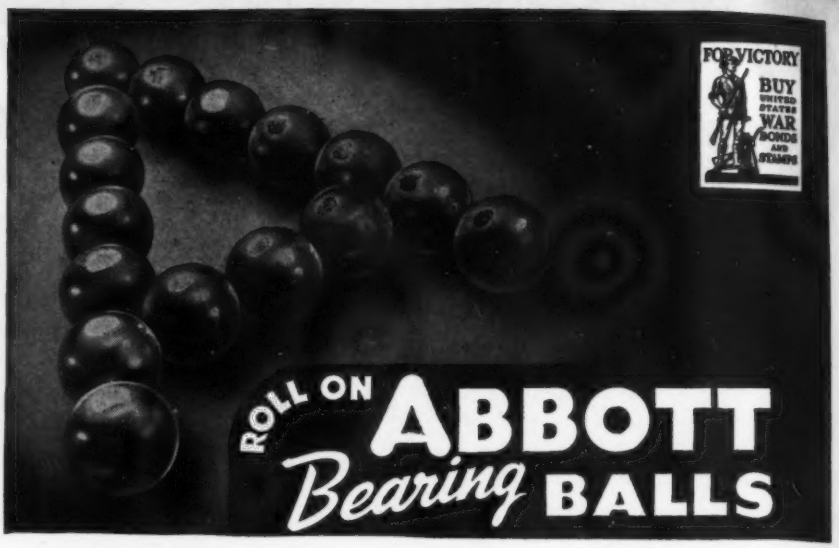
Write for price list No. 126

FOOD SERVICE & CONSERVATION DEPT.

VACUUM CAN COMPANY

25 S. HOYNE AVE. - CHICAGO 12, ILL.

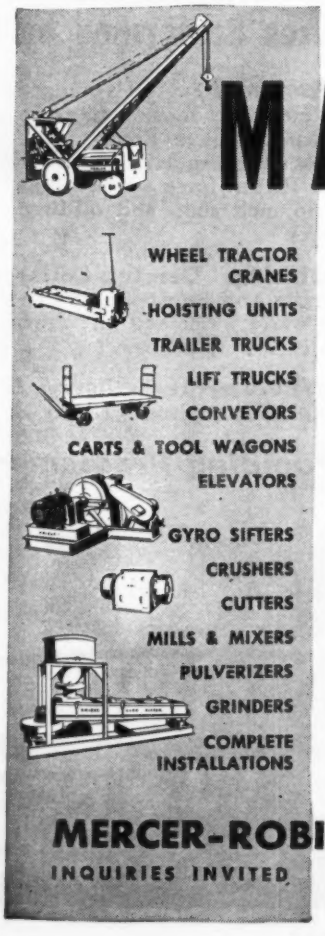
"AerVoiD"
VACUUM INSULATED CARRIERS
FOR STORING, TRANSPORTING
AND SERVING **HOT COFFEE**



GET *UNINTERRUPTED* PERFORMANCE

- Ask for delivery estimates on the grade of ball to match your standards of precision
- **SPECIFY "ABBOTT"**

ROLL ON ABBOTT Bearing BALLS
THE ABBOTT BALL COMPANY HARTFORD, CONN. U.S.A.



MATERIALS HANDLING & PROCESSING EQUIPMENT

The handling equipment construction "know-how" of the Mercer Engineering Works, Inc., Clifton, N. J. . . . The more than 40 years processing equipment experience of Robinson Mfg. Co., Muncy, Pa. . . . All are embodied in and represented by

MERCER-ROBINSON COMPANY, INC.
INQUIRIES INVITED
30 CHURCH ST., NEW YORK 7, N. Y.

Within Easy Reach... EVERYWHERE!

Foxboro Branches in 30 Cities Insure Speedy Instrument Service!

No matter where your plant is located in the United States or Canada, there is a Foxboro Branch nearby, to give you prompt service in obtaining the best in instrumentation!

At thirty Branch Offices in principal cities, engineering counsel and expert maintenance and repair service are always available . . . also stocks of parts and new or exchanged instruments, at many points. In addition, four Branch Factories* in strategic cities furnish complete assembly, repair and overhaul service using genuine factory-made parts, *exactly as it would be done at the Main Factory!*

Here's a combination of advantages you can't afford to overlook! A complete line of indicating, recording and controlling instruments of the most advanced, efficient design . . . PLUS on-the-spot service to supply *the right* instrument *when you need it!* Write for information on any phase of instrumentation that you may require.

FOXBORO
REG. U. S. PAT. OFF.
Instruments

RECORDING - CONTROLLING - INDICATING

★THE FOXBORO CO.
24 Neponset Avenue,
Foxboro, Mass., U. S. A.

ATLANTA, GA.
BALTIMORE, MD.
BOSTON, MASS.
☆CHICAGO, ILL.
CINCINNATI, OHIO
CLEVELAND, OHIO
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DENVER, COL.
DETROIT, MICH.
HOUSTON, TEXAS
☆LOS ANGELES, CAL.
☆NEW ORLEANS, LA.
NEW YORK, N. Y.
☆PHILADELPHIA, PA.
★PITTSBURGH, PA.
PORTLAND, ORE.
ROCHESTER, N. Y.
ST. LOUIS, MO.
ST. PAUL, MINN.
SALT LAKE CITY, UTAH
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SEATTLE, WASH.
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PEACOCK BROTHERS LIMITED
CALGARY
★MONTREAL
SYDNEY
TORONTO
VANCOUVER
WINNIPEG

★Factories
☆Repair Shops

G E N E R A L C A B L E

WESTERN UNION

1206

$

CHECK

ACCOUNTING INFORMATION

TIME FILED

A. N. WILLIAMS, PRESIDENT — NEWCOMB CARLTON, CHAIRMAN OF THE BOARD — J. C. WILLEVER, FIRST VICE-PRESIDENT

...subject to the terms on back hereof, which are hereby agreed to

1944, FEB. 17

TO OUR CUSTOMERS:

CONTINUING OUR SURVEY OF THE PRACTICES, CONDITIONS AND PROCEDURES THAT HAVE BEEN EXISTENT IN THE WIRE AND CABLE INDUSTRY OVER A PERIOD OF YEARS, WE ARE SATISFIED THAT THE ELIMINATION OF SOME OF THESE POLICIES CANNOT HELP BUT RESULT IN SUBSTANTIAL BENEFITS TO ALL BRANCHES OF THE ELECTRICAL INDUSTRY, TO ALL CUSTOMERS AND TO THE GENERAL PUBLIC. AS OUR STUDIES DEVELOP THE NEED FOR CORRECTIVE MEASURES, WE WILL, IN LINE WITH OUR CONSISTENT POLICY, PROMPTLY INSTITUTE SUCH CHANGES AS EXPERIENCE AND CONSIDERED OPINION WARRANT.

AT THIS TIME WE FEEL IT INCUMBENT UPON US TO ASSUME "CLEARANCE OF THE DECKS" IN RESPECT TO REELS, SPOOLS AND CASES WHICH ARE USED FOR THE SHIPMENT OF PRODUCTS OF OUR MANUFACTURE.

EFFECTIVE MARCH 1, ALL GENERAL CAPLE CORPORATION CONTAINERS WILL BE SHIPPED ON A "NO CHARGE" BASIS AND NO PAYMENT OR DEPOSIT WILL BE REQUIRED.

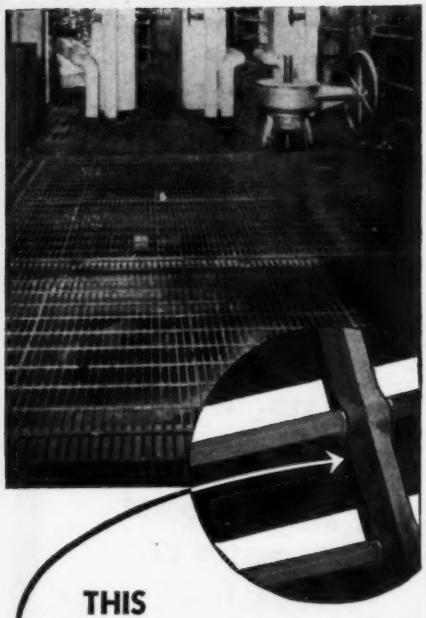
WE HAVE CONFIDENCE THAT OPERATION OF THIS PLAN WILL RECEIVE THE SUPPORT AND COOPERATION OF ALL PARTIES AT INTEREST, ELIMINATING AS IT DOES THE PRESENT COSTLY AND MANPOWER-CONSUMING METHOD OF HANDLING CONTAINERS. IT IS REQUESTED THAT ALL GENERAL CABLE CORPORATION RETURNABLE TYPE CONTAINERS BE RETURNED PROMPTLY, FREIGHT COLLECT.

WE WILL ALLOW CREDIT FOR THE RETURN OF ALL CONTAINERS YOU HAVE BEEN BILLED FOR AS CONTAINERS AND WHICH YOU HAVE PAID FOR, PROVIDED THEY ARE RETURNED IN GOOD CONDITION ON OR BEFORE FEBRUARY 28, 1945. AFTER THAT DATE, NO CREDIT WILL BE ALLOWED FOR THE RETURN OF CONTAINERS.

THE COOPERATIVE EFFORT OF ALL CONCERNED WILL DETERMINE THE EFFECTIVENESS OF OUR POLICY AND OF OUR ABILITY TO CONTINUE IT.

GENERAL CABLE CORPORATION....

C O R P O R A T I O N



THIS
SCRAPER TREAD OF
BATES-GRATES
OPEN STEEL FLOORING
GIVES THE
COMBINATION OF SAFETY AND CLEANLINESS
YOU WANT IN OPEN STEEL FLOORING

This extra cleanliness and safety come with the use of welding technique that, for years, has been recognized as the correct method to follow—a simple fillet weld.

There is no burning and no overflow of surplus metal around the fillet into which is press-welded Bates Hex Bar Stock. You get top strength and rigidity in steel flooring that permits the maximum passage of air and light.

Write for copy of well-illustrated, 8½" x 11" CATALOG NO. 43-44. It gives complete data on fillet welded Open Steel Flooring and Stair Treads.

WALTER BATES COMPANY, INC.
JOLIET • ILLINOIS
OPEN STEEL FLOORING • STAIR TREADS

LIKE A GIANT'S HAND

A Stevedore Jr. will supply you with the hands of ten ordinary men. Like a giant's hand it takes the "grunt" and fatigue out of lifting. Saves man-hour-handling in loading, unloading, stacking and elevating operations. Ideal for low-stacking work, easily rolled to the job. Quick-acting "Cam-lock" Portable standards provide a range of adjustments to meet varied operating conditions . . . from 14" level to delivery height of 74". This new Stevedore Jr. model, designed to meet your needs, completes the famous, already proven line of Rapid-Power Boosters. It plugs in on standard 110 volt lighting circuit and lifts a 225 pound distributed load at the rate of 50' per minute!

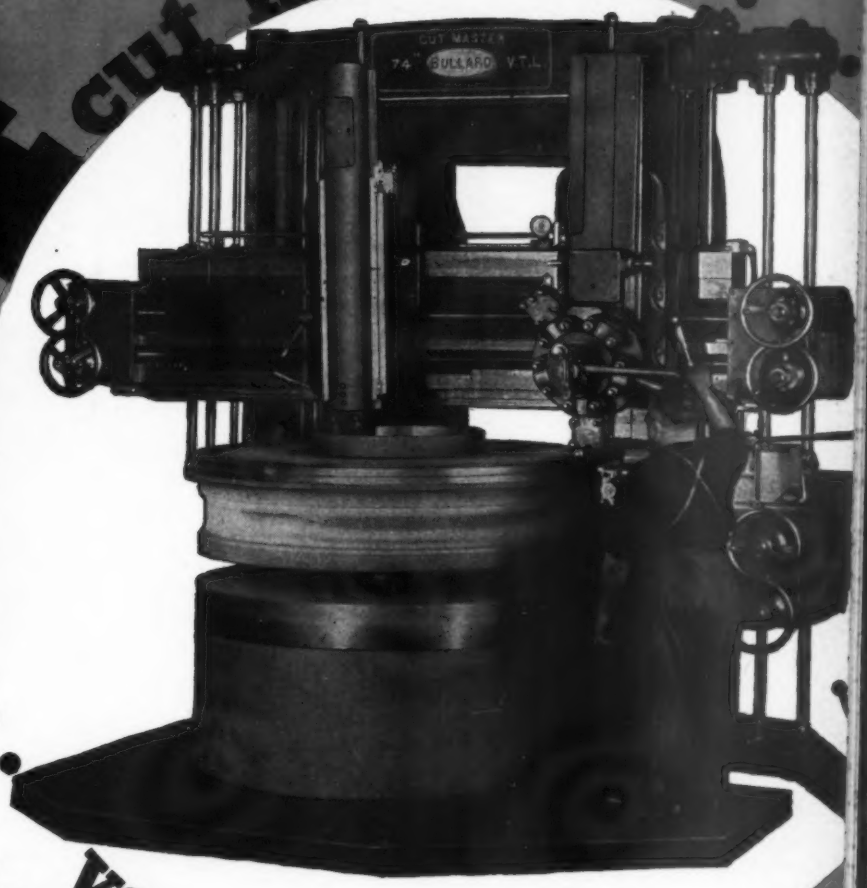
Send for complete information about this easy way to meet and beat the manpower crisis. Write the Rapids-Standard Company, Inc., 5351 Bond Ave., N.W., Grand Rapids 2, Michigan.

OFFICES IN PRINCIPAL CITIES

RAPIDS-STANDARD
POWER BOOSTER

VERSATILITY IN THE LARGEST BULLARD

the 74" cut master . . .



. . . vertical turret lathe . . .

Cut Master has available three types of heads: Verticle Ram Head, Vertical Turret Head on the main rail, and Side Head on side rail. Each head is equipped with its own individual range of feeds and power traverse. Select any of six head combinations to meet your requirements.

2 Ram Heads and Side	2 Ram Heads
Ram, Turret and Side	Ram and Turret
Turret and Side	One Ram and Side

Widely variable speed ranges upon request.

These versatile machines can also be equipped for thread cutting, drum scoring, or angle turning.

Ask Bullard Engineers about the Four Speed Ranges obtainable.

Send for Circular, giving full specifications.

THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT

On the Job for Victory

YESTERDAY

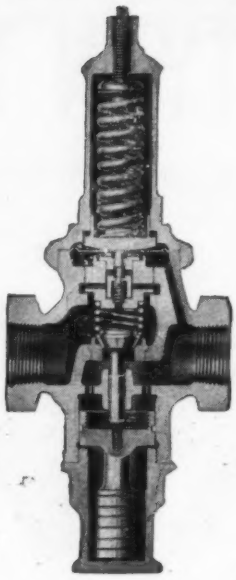
AND TODAY

Masoneilan controls and regulators have served industry faithfully since 1882. And are now serving war industries in America and the United Nations . . . well.

Having seen history repeat itself many times, Mason-Neilan was again ready, when this war started, to supply industries with automatic controls and regulators . . . each with the built-in quality characteristics that assure dependable, accurate performance and long life.

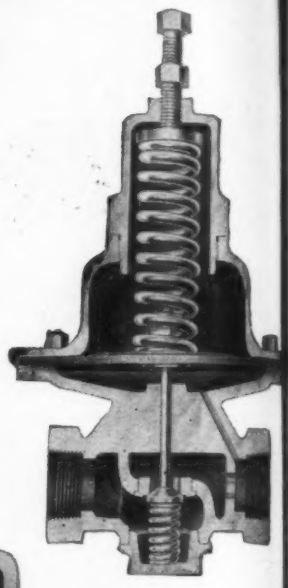
Thousands of Masoneilan controls and regulators are in use on land and sea helping to speed victory. Many more are on their way.

A portion of our production of the items illustrated is now available for other than war industries for maintenance and replacement. Catalog 71 is available. Write for a copy.

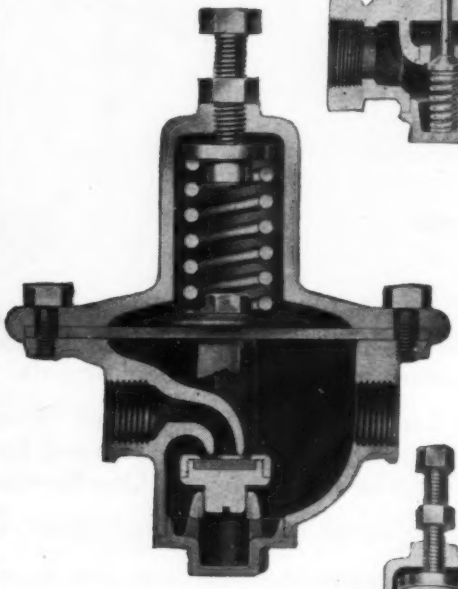


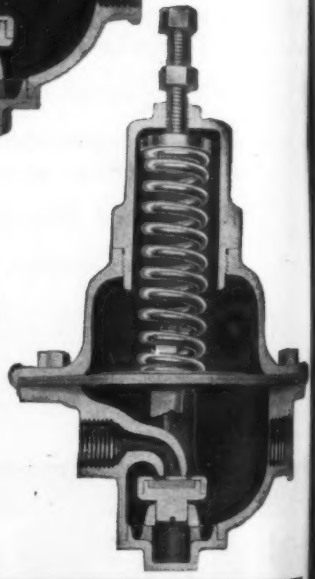
No. 11
For reducing steam pressures. Pilot operated. Sizes — bronze up to 2". Reduced pressure ranges between 5 and 225 lbs.

No. 33
For small steam or air lines, unit heaters or single radiators. Sizes up to ¾". Reduced pressure ranges between 2 and 100 lbs.



No. 227
For domestic or industrial water systems. Requires no attention for years. Sizes ¼" to 2". Reduced pressure ranges between 10 and 60 lbs.





No. 414
For reducing air pressure in industrial service. Also recommended for dead end service. Sizes ¼" to 2". Reduced pressure ranges between 10 and 60 lbs.

MASONEILAN

Mason-Neilan Regulator Co.

1191 ADAMS STREET, BOSTON 24, MASS., U.S.A.

New York Buffalo Philadelphia Pittsburgh Tulsa Toledo
Chicago Atlanta St. Louis San Francisco Los Angeles
Houston Mason Regulator Co., of Canada, Ltd., Montreal

DU PONT "THREE DIMENSIONAL SEEING"

Helps Produce More War Goods

BEFORE: Dark, dingy color on a machine makes it a hazard to workers and slows down production. It is a source of eyestrain and errors.

AFTER: What a difference when the machine is repainted with Du Pont Horizon Gray . . . and working surfaces are highlighted with "Spotlight Buff." Here is "Three Dimensional Seeing" at work—providing easier, more comfortable vision that reduces accidents and speeds production.

"Production has increased 10% in 10 months," says Mid-West Instrument Manufacturer

This manufacturer has done a lot of things to speed production and protect the efficiency of his wartime employees. The application of Du Pont "Three Dimensional Seeing" was one step that paid big dividends.

The 10% increase in production came in the 10 months following repainting of 95 black machines in scientifically selected, light-reflecting colors. There was also a 25% reduction in accidents. The plant's maintenance engineer reported that in the workers' opinion "Three Dimensional Seeing" enables them to see more accurately than before, and *more comfortably* over sustained periods of time. The results: improved morale of operators and increased production of war materiel in this plant.

What is "Three Dimensional Seeing"? It's a unique system for repainting machinery so as to give your workers keener, faster, more accurate sight.

You select machines now painted in dark colors that absorb light, and repaint them in light colors that *reflect* light. Working surfaces on the machines you repaint in a lighter color that contrasts with the material being worked and also with the dangerous moving parts of the machine.

This is the secret of "Three Dimensional Seeing." It enables the worker to see depth. His work is more clearly defined against the lighter background of the machine. Light is reflected from all sides—not just from above. Dark shadows are eliminated. He sees more clearly and works more safely.

These are the advantages being experienced today by more than one thousand plants all over the country.

DU PONT

THIS COUPON will bring you further information about the new work-speeding development, "Three Dimensional Seeing." Fill it in now . . . check the items that interest you . . . drop it in your "Outgoing" box.

E. I. du Pont de Nemours & Co. (Inc.), Finishes Division, Dept. FM34, Wilmington, Del.

I'D LIKE TO SEE:

☐ *Your latest booklet, "The Visual Way to Victory through Three Dimensional Seeing."*

☐ *The new film, "Salvaging Waste Light for Victory." Tell me how I may arrange for a showing.*

☐ *How "Three Dimensional Seeing" can be applied to my problem. Send me a Du Pont Service Engineer.*

NAME_____

TITLE_____

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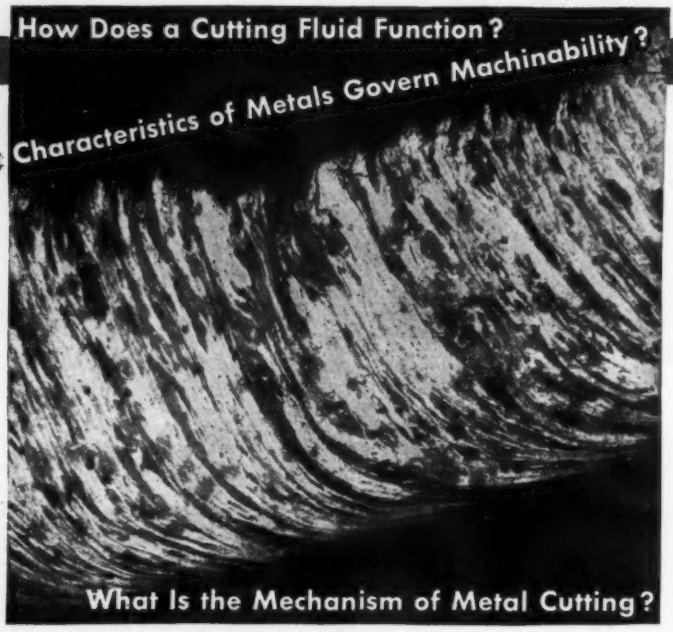
Consider the Lowly Chip..


How Does a Cutting Fluid Function?
What Characteristics of Metals Govern Machinability?
What Is the Mechanism of Metal Cutting?

What Knowledge Its Gnarled Features Hide!

We're moved to poetic expression when we contemplate the great advances in metal-working which become possible as more and more is learned about the formation of a metal chip. Too long the chip has been taken for granted as just something which happens when you cut metal. Scientific investigation is bringing to light data which may greatly alter present day conceptions of tool angles, depth of cut, tool speeds, cutting fluids and other factors which are a part of metal cutting.

Through study of the metal chip come further answers to three fundamental questions: "What is the mechanism of metal cutting?" "What characteristics of metals govern machinability?" and "How does a cutting fluid function?"

A REQUEST OF STUART CUSTOMERS

Containers of all types are critically scarce. We urge you to cooperate with the W.P.B. program to conserve containers by observing these four rules for handling drums.

1. Do not drop.
2. Use a little oil to avoid stripping threads in removing plugs.
3. Replace plugs carefully when drum is empty.
4. Keep drums under cover when emptied.

We at D. A. Stuart Oil Co. are probing these mysteries with all the tools and techniques science makes available. We don't know all the answers yet, but we're learning them fast. As our research engineers inch closer and closer to the truth about the metal chip, their findings are reflected in improved cutting fluids—*to do a better job for you.*

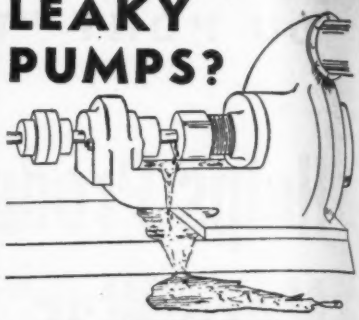
We invite you to write for our new free booklet, "The 577th Oil," which contains twenty-two case histories, typical examples of how Stuart Oil Engineering is solving production problems (like your own), as well as other valuable metal-working data. Please state your name, company and title.

Thred Kut · CODOL · Super Kool · DA

D. A. STUART OIL CO.
LIMITED
2735 SOUTH TROY STREET
CHICAGO 23, ILLINOIS
ESTABLISHED 1865
Warehouses in Principal Metal-Working Centers

STURACO · SOLVOL · KLEEN KUT

LEAKY PUMPS?



SYNTRON
REG. TRADE MARK

"ANTI-FRICTION"
REPLACEMENT SHAFT SEALS

Eliminate Leakage & Repacking Expense

Easy to Apply—Comes as a complete Unit—Slip over the shaft—Clamp tight to cage—For up to 6 in. shafts.

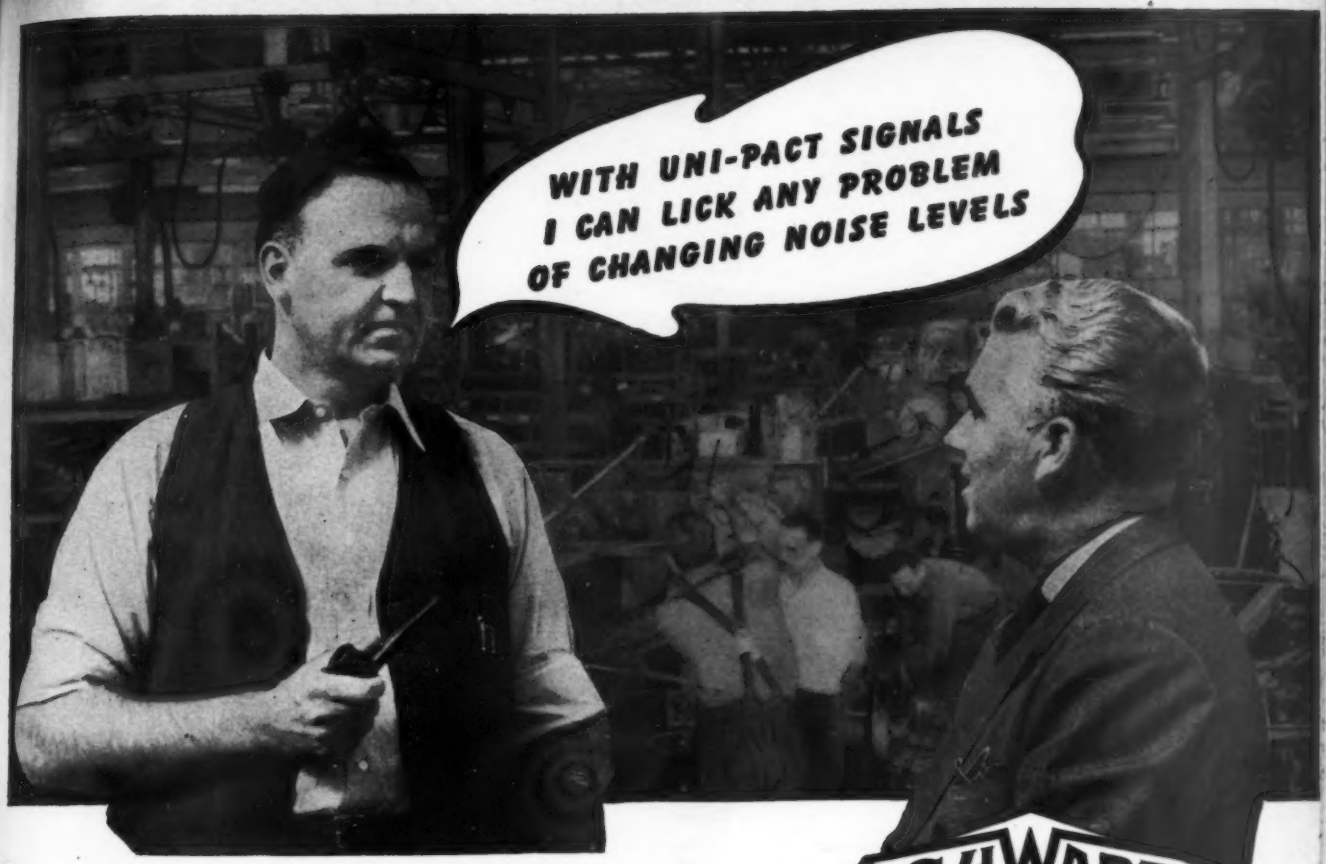
SYNTRON CO. 480 Lexington Ave. HOMER CITY, PA.

SAVE TIME
WITH
COFFING'S "SAFETY-PULL" RATCHET LEVER HOIST

Hundreds of war plants are speeding production by equipping their maintenance and construction crews with "SAFETY-PULL" ratchet lever hoists. They can easily be carried about by one man, will operate in any position, and may be used for either pulling or lifting. A real tool for those inevitable maintenance jobs.

Write today for Catalog SG-6

COFFING HOIST CO.
DANVILLE, ILLINOIS



SCHWARZE FARADAY

AUDIBLE ELECTRIC SIGNALS

Maximum Flexibility at no added cost

with the famous

SCHWARZE-FARADAY UNI-PACT DESIGN

There is no better, more economical way to simplify plant signal problems than to install the famous Schwarze-Faraday UNI-PACT feature. This most modern of all signals saves time, maintenance and installation costs. One outlet, with a single adapter-plate allows you to meet changing plant conditions by merely plugging in Bell, Horn or Kodaire, as required.

The Schwarze-Faraday Complete
Line Contains Signals for Every Plant Need

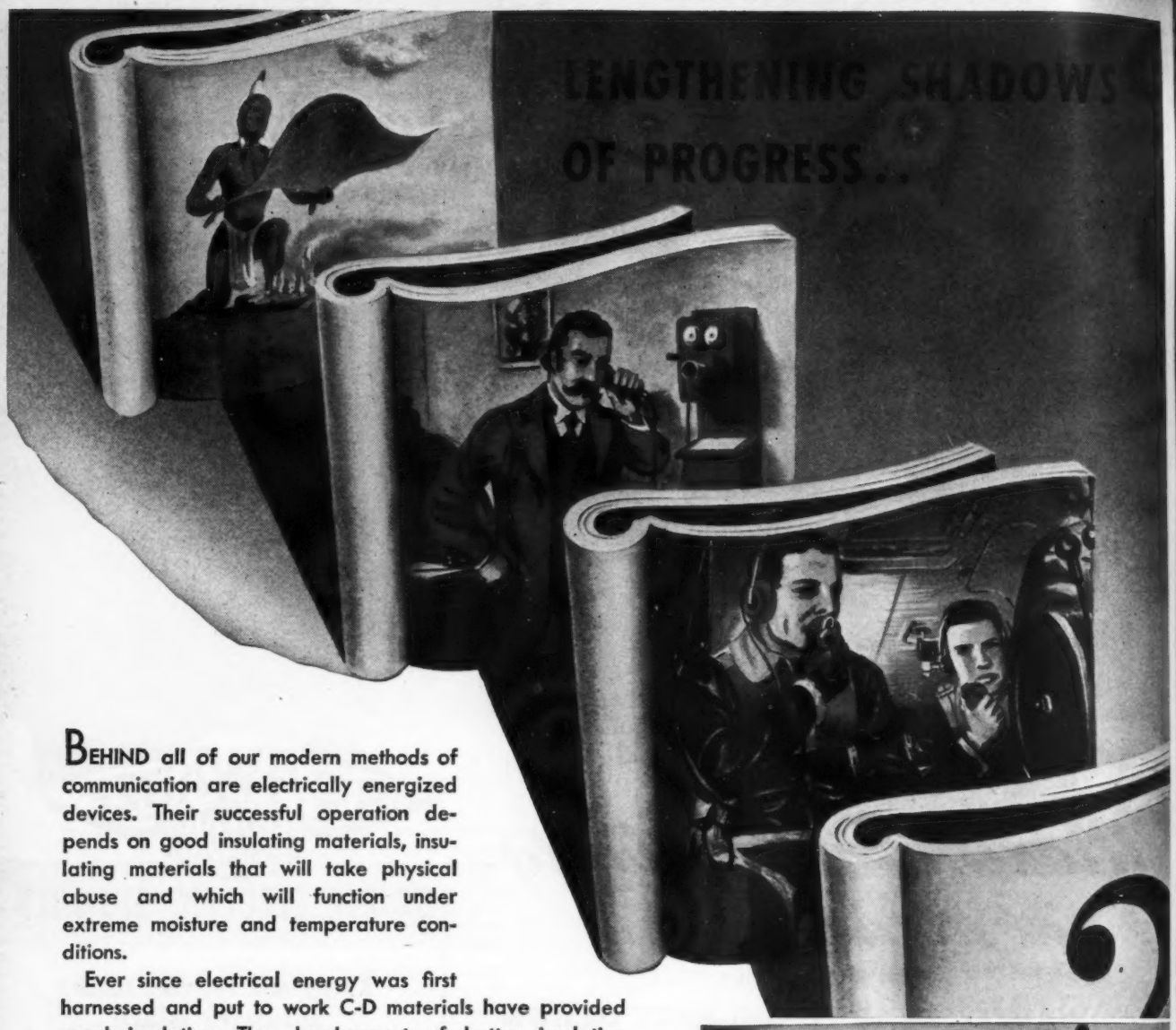
Included are Horns, Bells, Buzzers, Air-Trumpets, Kodaires and Chimes, all durable, dependable, and economical. Our factory-trained engineers will gladly assist you in designing installations in exact accordance with your plant requirements.

They all fit the same adapter plate

UNI-PACT Saves Time, Maintenance and Installation Costs
The Dead Front Adapter-Plate is a part of each UNI-PACT signal assembly. It is identical for all sizes and fits each one without change of electrical connections.

Send for FREE Catalog—Completely indexed, illustrated, and convenient to use, our new Buyers Book of Electrical Signals will prove an invaluable reference guide.

SCHWARZE ELECTRIC COMPANY
ADRIAN, MICHIGAN



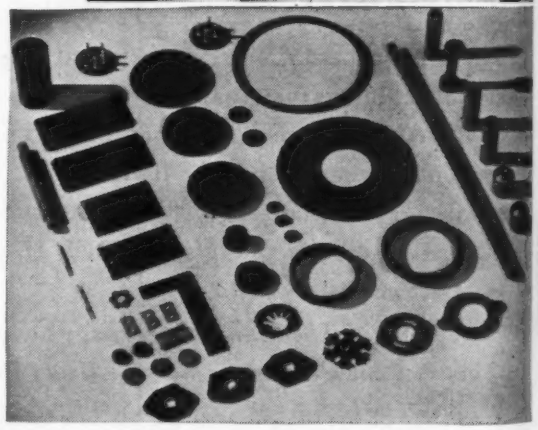
BEHIND all of our modern methods of communication are electrically energized devices. Their successful operation depends on good insulating materials, insulating materials that will take physical abuse and which will function under extreme moisture and temperature conditions.

Ever since electrical energy was first harnessed and put to work C-D materials have provided good insulation. The development of better insulating materials has been the constant goal of the C-D laboratory. The success of C-D's efforts have been the lengthening shadows which have forecast the phenomenal advances which this country has made in the field of communications.

1st DIAMOND Vulcanized FIBRE; then DILECTO, a moisture proof insulation; 3rd VULCOID, which combines to a remarkable degree the desirable properties of both DIAMOND Fibre and DILECTO; 4th MICABOND—Mica insulation in its most usable form and now DILECTENE, a pure resin plastic especially for U-H-F insulation.

C-D engineers have helped solve thousands of insulating problems. They have accumulated a wealth of "know how" which is at your disposal to help solve your electrical insulation problem.

DISTRICT OFFICES: New York - Cleveland - Chicago - Spartanburg, S. C. West Coast Rep., Marwood, Ltd., San Francisco - Sales Offices in principal cities



C-D products include THE PLASTICS... DILECTO—a laminated phenolic; CELORON—a molded phenolic; DILECTENE—a pure resin plastic especially suited to U-H-F insulation... THE NON-METALLICS, DIAMOND Vulcanized Fibre; VULCOID — resin impregnated vulcanized fibre; and MICABOND—built-up mica insulation. Folder GF describes all these products and gives standard sizes and specifications.

CH-43

Continental - Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE

Lyon Adjustable Wood Shelving. Open and closed types. Shelving adjustable every 3" vertically and horizontally—no tools necessary. Quickly set up by inexperienced help with one tool—a screw driver!

Lyon Wood Cabinets. Trim design and attractive finish makes these cabinets a match for any steel cabinets or other equipment now in use. 3 types available; Storage, Wardrobe, and Combination Storage and Wardrobe (illustrated).

Lyon Shoprobe. Takes up less floor space per person than the area covered by a man's hat! Gives safe, convenient, mobile storage for workers' clothing.

"Indispensables" NOW and POST-WAR

● If you have a wartime problem of releasing needed floor space, faster handling of parts in work, or better control of tools and inventory . . . or if you are laying plans for quick reconversion when victory is won . . . Lyon can help you in two ways.

1. Lyon's complete line of Shop and Storage Equipment provides engineered units that help solve problems of space conservation, production acceleration, tool protection, and materials control. All of this Lyon Equipment is now available on satisfactory priority.

2. Lyon Surveys have proved their worth in hundreds of leading industrial plants. They include a thorough analysis of present storage, toolroom and materials handling equipment . . . and recommendations for the selection and arrangement of equipment for maximum efficiency and economy.

Ask your Mill Supply Distributor for Catalogs showing Lyon Equipment available for prompt delivery on satisfactory priority. Write us for details on Lyon Survey Service.

Lyon Work Bench. No. 5100. With Half Depth Shelf, Back Stop and Two End Stops. 60" long, 28" deep, 34" high. Drawer 12" wide, 16" deep, 4" high. Complete as shown $20.50 Without drawer $17.55.

Lyon "H" Shop Box—No. 421F14. 12" x 18" x 6"—18 gauge steel, $1.60.

Lyon "L" Shop Box—No. 410F16. 11" x 22" x 6"—16 gauge steel, $0.95

Machine Tool Cabinet No. 2345-1. Heavy steel bench top makes a sturdy mounting for small grinders and vises. Shelves furnish 12 sq. ft. of storage area protected by double swinging doors. 36" wide, 24" deep, 37" high including back stop. $17.05.

Lyon Tool Toter—No. 2983-11. With Flange-edge Top, Two Drawers, one Flange-edge Shelf, and Casters. 18" x 24" x 34-1/2". Drawers 15" x 23-1/2" x 4-5/8". $11.30.

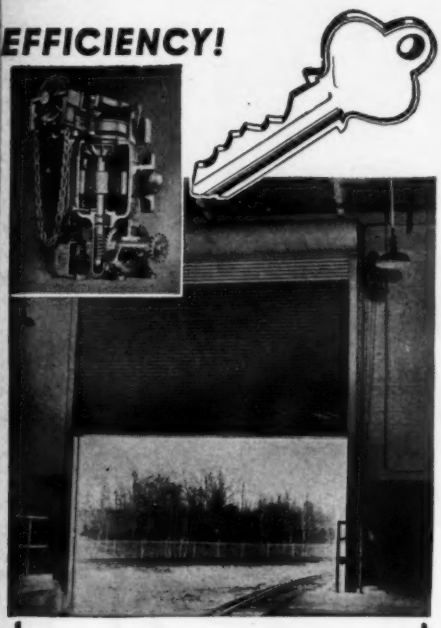
Lyon Bench Legs—No. 2401-11. 28" x 32-1/4". Made of heavy "T" formed steel. Ideal for steel or wood top benches, wood top tables and machine mountings. $2.95.

LYON METAL PRODUCTS, INCORPORATED

General Offices: 364 Madison Ave., Aurora, Ill.

Branches and Distributors in All Principal Cities

HERE'S THE KEY
to REAL DOOR
EFFICIENCY!



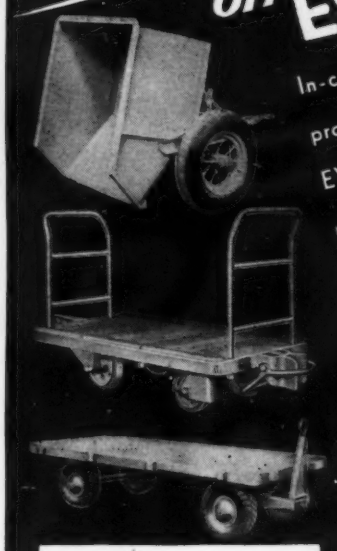
KINNEAR
MOTOR OPERATED
ROLLING DOORS

The time-saving, space-saving efficiency of *coiling upward action*—a Kinnear Door advantage that is more vital now than ever before—can be increased still further with *motor operation*. When equipped with rugged, dependable Kinnear Motor Operators, doors can be raised or lowered quickly and safely, from any number of convenient locations, by a momentary touch on the "OPEN" or "CLOSE" button. For safety, a touch of the "STOP" button will bring the doors to an immediate halt at any point in their ascent or descent. And they can be *either* raised or lowered from any intermediate position. Make sure your doors lend maximum aid to the flow of production with the *motorized efficiency* of Kinnear Rolling Doors. Write for information.

THE KINNEAR MFG. CO.
1540-60 Fields Ave., Columbus 16, O.
Offices and Agents in Principal Cities

Saving Ways in Doorways
KINNEAR
ROLLING DOORS

Watch how materials GET GOIN' on EWC TRAILERS!



In-coming and out-going materials and products move faster, surer, safer, on EWC Trailers. Engineered to do the job right, EWC Trailers embody 90 years of practical experience in helping many types of industries solve their Materials Handling problems.

Let us help you. Write today for Illustrated Bulletins and full details.

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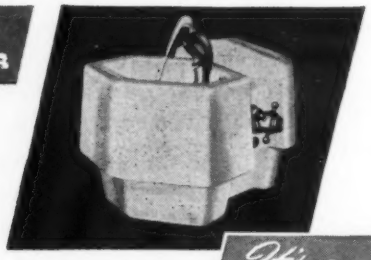
EWC TRAILERS

It's a HALSEY TAYLOR



It's a HALSEY TAYLOR

That's all you need to know about a fountain!

Whether it's a cooler, or a pedestal or wall fountain, if it's a Halsey Taylor it's the fixture best adapted to plant installations. Patented features promote sanitation and the vitally necessary freedom from contamination that means so much to the health and satisfaction of the worker. The Halsey Taylor line is complete, providing types for office or shop, each the acme of enduring, trouble-proof service!

THE HALSEY W. TAYLOR CO., WARREN, OHIO

HALSEY TAYLOR
Drinking Fountains

PREVENT TIME LOSS

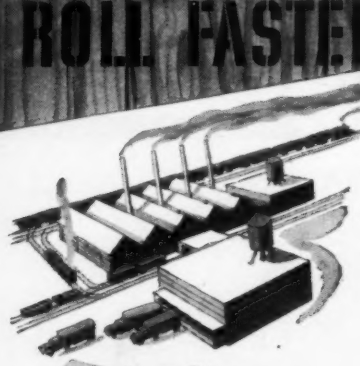
Protect their hands against oils, grime and paint

Supply your workers with Du Pont PRO-TEK, the hand cream that acts like an invisible glove. Quickly applied to hands and arms before starting work, it guards the skin against paint, grime, insoluble cutting oils and non-aqueous solvents (but should not be used against compounds which enter the circulation through the skin). Easily washed off with water when the job is done and takes all the grime with it. Costs little . . . a sound investment in employee goodwill. Write for Free Sample.

AVAILABLE without priority. Ask your jobber about the economical gallon jar . . . or the convenient 8-oz. size. E. I. du Pont de Nemours & Co. (Inc.), Dept. FM-1, Wilmington 98, Delaware.

DU PONT PRO-TEK
REG. U. S. PAT. OFF.
HAND PROTECTIVE CREAM

STENCILED SHIPMENTS ROLL FASTER



YOUR SHIPMENTS ARE IMPORTANT

STENCIL ADDRESS YOUR SHIPMENTS with easily read, permanent stenciled markings—*they'll roll faster, and costly delays in transit will be eliminated.*

DIAGRAPH-BRADLEY manufactures a stencil cutter for every shipper's need. Machines are available for cutting letters ½", ¾", ⅞", 1¼", 1½" & 1¾". Most government export shipments require stenciling in letter size 1½" or larger. **Diagraph-Bradley is the only manufacturer making a stencil machine for cutting letters larger than 1".**

FOR BEST RESULTS USE

- D-B Inks
- D-B Stencil Board
- D-B Fountain Marking Brushes
- D-B Fountain Marking Pencils

D-B

World's Oldest and Largest Manufacturer of Stencil Machines

DIAGRAPH-BRADLEY

STENCIL MACHINES

DIAGRAPH-BRADLEY STENCIL MACHINE CORPORATION

No. 27 Diagraph-Bradley Building, St. Louis, 8, Missouri

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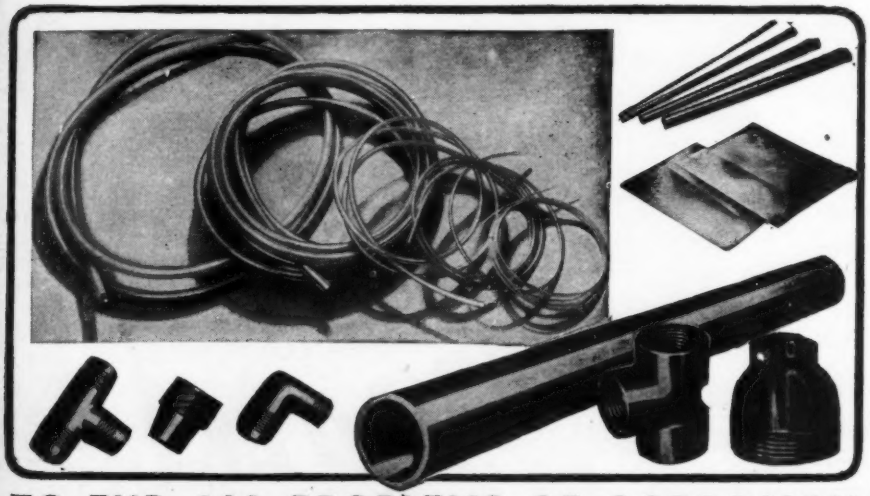
COMPLETE SHIPPING ROOM SUPPLIES



TO END ALL PROBLEMS OF CORROSION

Saran is a tough thermoplastic originally made to replace such strategic war materials as aluminum, stainless steel, nickel, copper, brass, tin and rubber. Now found adaptable to a wide range of uses in product designing, food processing and wherever non-corrosive materials are necessary. Its insulating qualities, flexibility and ease of handling make it extremely valuable in installations dealing with oils, gases, air, water and corrosive chemicals. It is available in tube, pipe, sheet, rod and molded fittings. Technical Bulletin P-8 will be sent on request. Address Dept. SJ.

Pat. No. 2160931

SARAN

HODGMAN RUBBER CO.
FRAMINGHAM, MASS.

NEW YORK . . . 261 Fifth Avenue
CHICAGO . . . 412 South Wells St.
SAN FRANCISCO . . . 121 Second St.

The Sign Of QUALITY

M H

VALVES HYDRANTS

and

PIPE LINE ACCESSORIES

M & H products are well known for high quality material and expert workmanship. They have been used in industrial plants for many years. The M & H line also includes B & S Cast Iron Fittings, Flanged Fittings, Flange and Flare Fittings, Valve Boxes, Shear Gates, Wall Castings, Cutting-in Tees and similar accessories.

CHECK VALVE

M & H valves are used in industrial plants for water, gas, steam, oil, chemicals and are furnished in all commercial sizes from 2" to 30", inclusive. They are cast iron body, bronze mounted, furnished double disc parallel seat or solid wedge. They are heavily proportioned and have a high factor of safety.

OTHER M & H PRODUCTS

Fire Hydrants	Floor Stands
Gate Valves	Extension Stems
Tapping Valves	Mud Valves
Special Castings	Flap Valves
Tapping Sleeves	Sludge Shoes
Check Valves	

Write for Catalog 34

M & H VALVE AND FITTINGS COMPANY

ANNISTON, ALABAMA

Production Executives agree:

"No Reconversion from American Phillips Screw-Driving

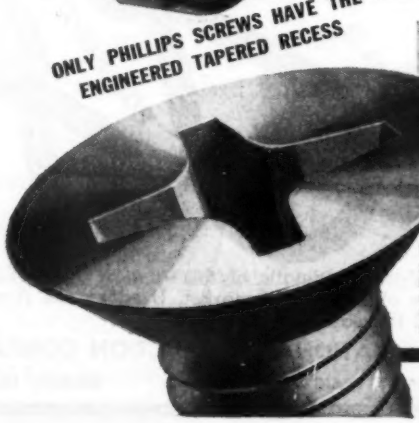
. . . from now on we'll need that Speed and Cost-Control more than ever before"

There's one sure thing in the plans of modern war plant executives . . . they'll never go back to the slow, slip-and-slash, high cost method of assembly with old-fashioned slotted head screws. They'll hold the gains they've made with American Phillips Screws which average better than 50% in assembly time, plus the elimination of rejected work and spoiled materials, thanks to the automatic alignment of the 4-winged Phillips Driver that stays with the tapered recess until the screw has been set up straight and tight.

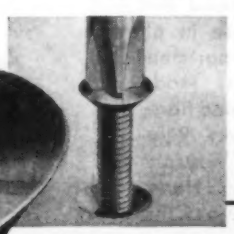
A comparison of the cost of driving Phillips and Slotted Head Screws will show that it actually costs less to have the advantages of the Phillips Recess.

American brand of Phillips Recessed Head Screws are made under rigid laboratory check, and a unique system of piece inspection. Delivery service is maintained by high speed production. And engineering service is at *your* service on any special fastening problem.

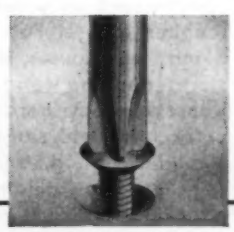
AMERICAN SCREW COMPANY
PROVIDENCE, RHODE ISLAND
Chicago: 589 E. Illinois Street *Detroit:* 502 Stephenson Building



ONLY PHILLIPS SCREWS HAVE THE ENGINEERED TAPERED RECESS



1. **Fast Starting**—Driver point automatically centers in the recess . . . fits snugly. Screw and driver "become one unit." Fumbling, wobbly starts are eliminated.



2. **Faster Driving**—Spiral and power driving are made practical. Driver won't slip out of recess to injure workers or spoil material. (Average time saving is 50%.)

3. **Better Fastenings**—Screws are set up uniformly tight, without burring or breaking heads. A stronger, neater job results and there are no gouges on work-surface.

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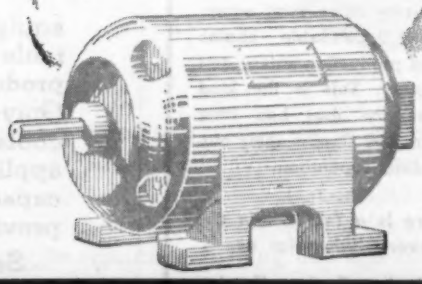
Stop putting up with motor burnouts, insist on Klixon built-in Protectors with every motor you buy. Your supplier can furnish motors with Klixon Protectors . . . A.C. all sizes; D.C. up to 30 volts.



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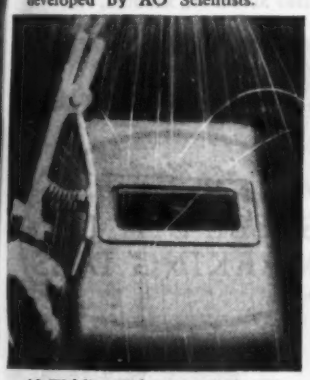

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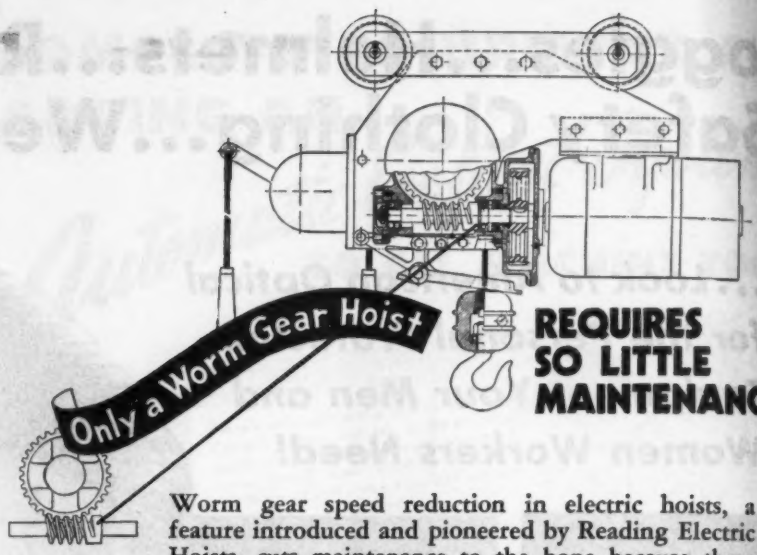

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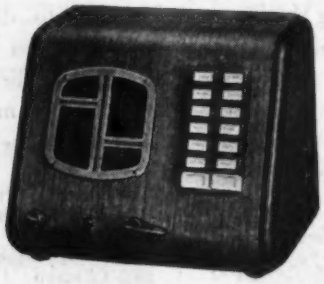

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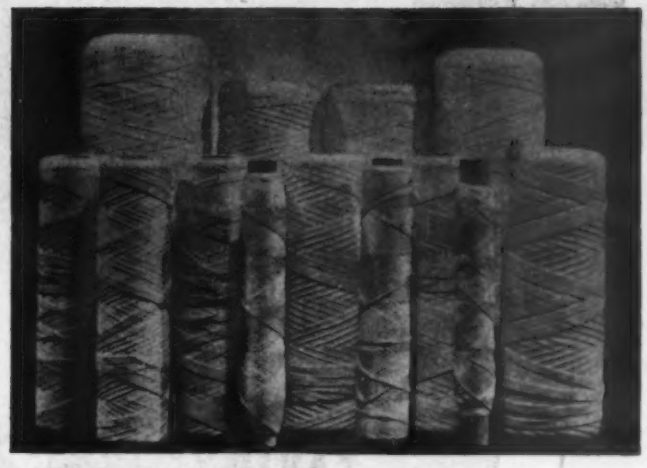

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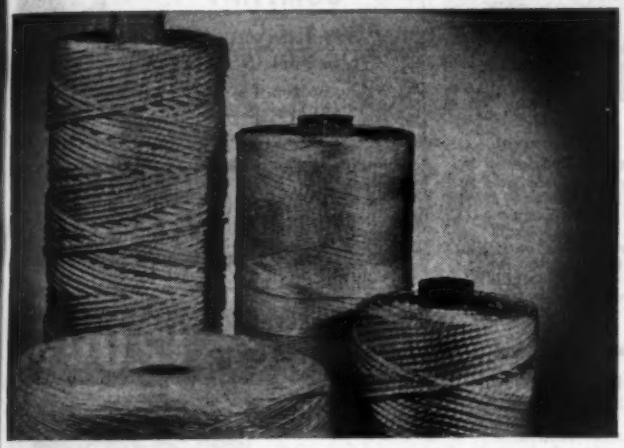

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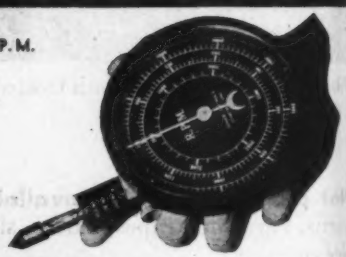

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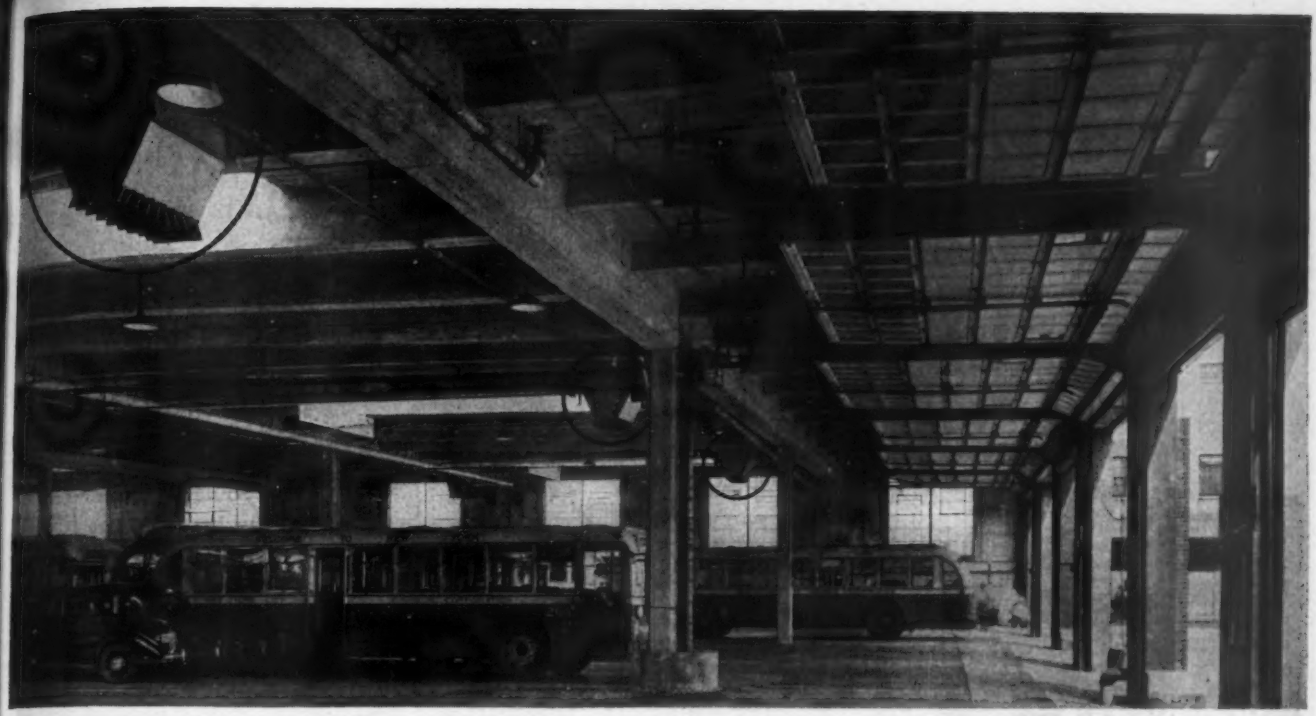

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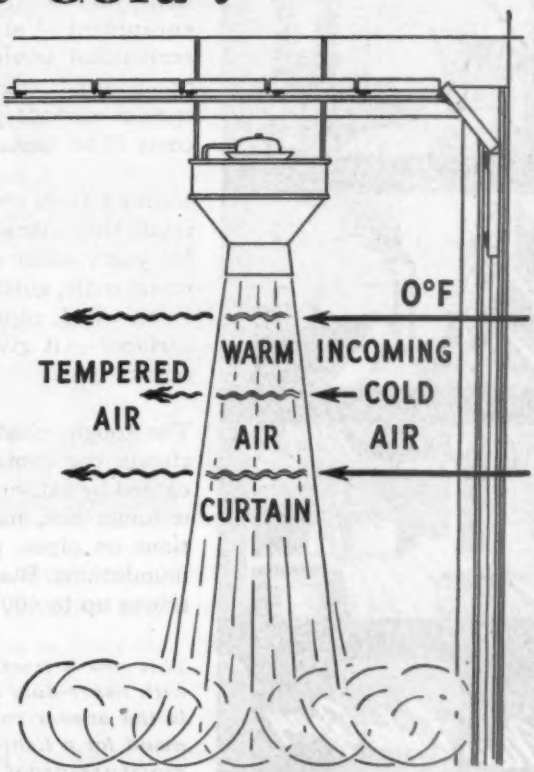

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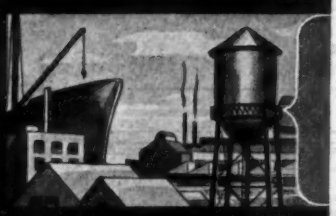

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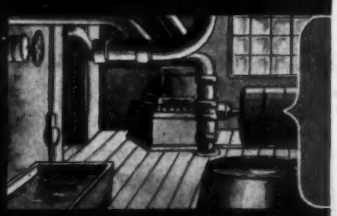

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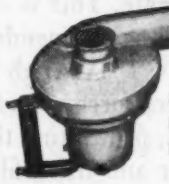

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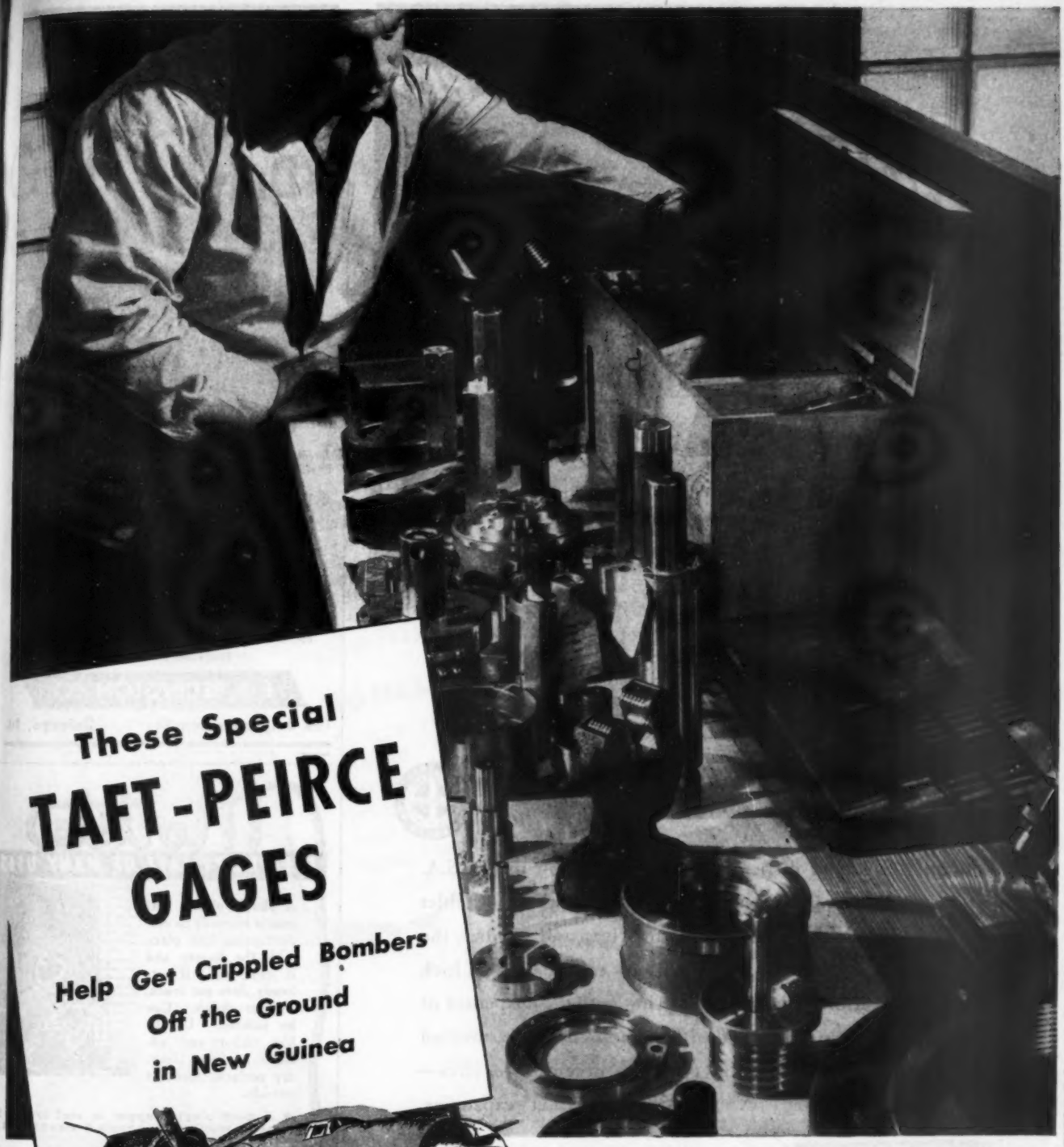

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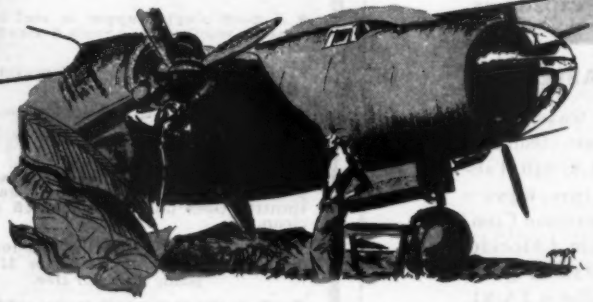


War Production has made necessary the manufacturing of many special gages in addition to our standard types so well known to industry.

Gages shown above typify some which we have manufactured to insure interchangeability of parts for tanks, planes, guns, and ammunition. The use of these gages on the home front has made possible the interchangeability so necessary to the replacement of parts on remote airfields in every war theatre, the repair work which puts tank casualties clanking back into action, and enables gun crews to restore the voices of silent guns. There is no end or limit to the uses of Taft-Peirce special gages . . . or to the ability of the Taft-Peirce Small Tool and Gage Division to design and produce them to *your* particular needs.

THE TAFT-PEIRCE MANUFACTURING COMPANY

Woonsocket, Rhode Island

Guard your workers

AGAINST
HEAT SICKNESS
with

M·S·A
SALT TABLET
DISPENSERS

POSITIVE ACTION
EASY-TO-OPERATE
WEATHERPROOF-DUSTPROOF

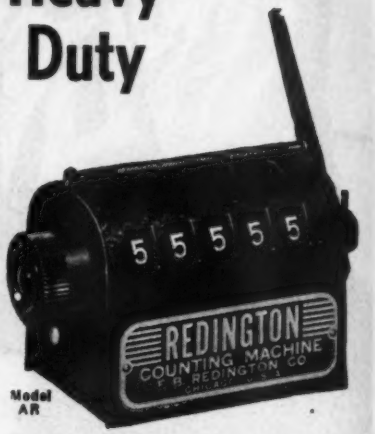
A simple, one-hand dispensing arrangement on this M.S.A. Ceramic Model Salt Tablet Dispenser discharges one tablet at a time *every time.* Easy to take apart, clean and sterilize, the Dispenser is so designed that a padlock can be used to lock the unit in position to prevent tampering with the Dispenser or its contents. The streamline-designed, non-corrosive, molded porcelain body is finished in two-tone green. Two sizes—500 or 1500-tablet capacities.

M·S·A SALT TABLETS

Packaged in convenient waxed cardboard cartons to keep them clean and free from moisture, M.S.A. Salt Tablets are available in two types—Sodium Chloride and Dextrose Combination or plain Sodium Chloride; each in the 500 and 1500 sizes. Quick dissolving. Write for Bulletin FA-81.

MINE SAFETY APPLIANCES COMPANY
Braddock, Thomas and Meade Sts., Pittsburgh, Pa.
District Representatives in Principal Cities

Built for Heavy Duty



These "watchdogs of production" are bulldogs in ability to do heavy duty on the toughest war jobs. The construction of Redington Counters is the finest, the design simple, the best grades of steel are used and all working parts are of steel. Models for many types of machines and industrial installations. Write for details.

Immediate Delivery

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A pliable plastic that comes all ready to use. Just press into place with the fingers and it stays put. It sets firmly, does not crack, chip or shrink. Can be painted. Unrolls like ribbon and adheres to any clean, dry surface, inside or outside.

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- **Used in shipping to hold parts firm, preventing friction, rust and damage in transit. Goes on fast, comes off easy and clean.**

About 80 feet of ¼" Mortite to a roll. Order through your Supply House or $1.25 postpaid. Circular free.

Mortite is also custom built to size and formula for a wide variety of applications. Submit your problem to us and get the benefit of our laboratory research in adapting Mortite to your use.

J. W. MORTELL COMPANY
Technical Coatings Since 1885
506 Burch St. Kankakee, Ill.

Government Recognizes Need of Better Sanitary Facilities in War Plants!

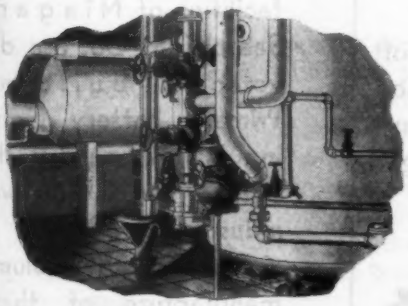
PRESIDENT ROOSEVELT WRITES WPB

In a recent letter on the desirability of sanitary facilities in industrial plants, President Roosevelt stated, "I am informed that many war production plants are now in need of these facilities. As a consequence, much production is being lost by loss of time during working hours and through induced absenteeism."

DONALD NELSON REPLIES

In his reply to the presidential message, Mr. Nelson stated, "Additional instructions are being issued to our entire organization to approve such essential in-plant facilities in war plants as cafeterias, rest rooms and locker facilities, when they are submitted by the War Department, Navy Department or the Maritime Commission."

The complete Crane line includes lavatories, wash-up sinks, closets, urinals, showers, drinking fountains—every plumbing item necessary for the industrial plumbing system.



The piping is an important part of every plumbing and heating system. The Crane line includes pipe, valves, fittings—everything necessary for the piping.

In many plants, hours of time are being wasted because of insufficient or inadequate washrooms.

Ample washroom facilities not only prevent this waste of time but also aid employee relations.

Crane specialized, industrial plumbing includes lavatories, closets, urinals, sinks, showers, and drinking fountains, as well as the essential piping, valves and fittings. All Crane equipment is sturdily constructed to stand the hard use to be expected in public washrooms.

Your plumbing contractor or nearest Crane Branch can aid you in equipping your washrooms and shower rooms and can offer you assistance in planning other sanitation facilities for your plant.

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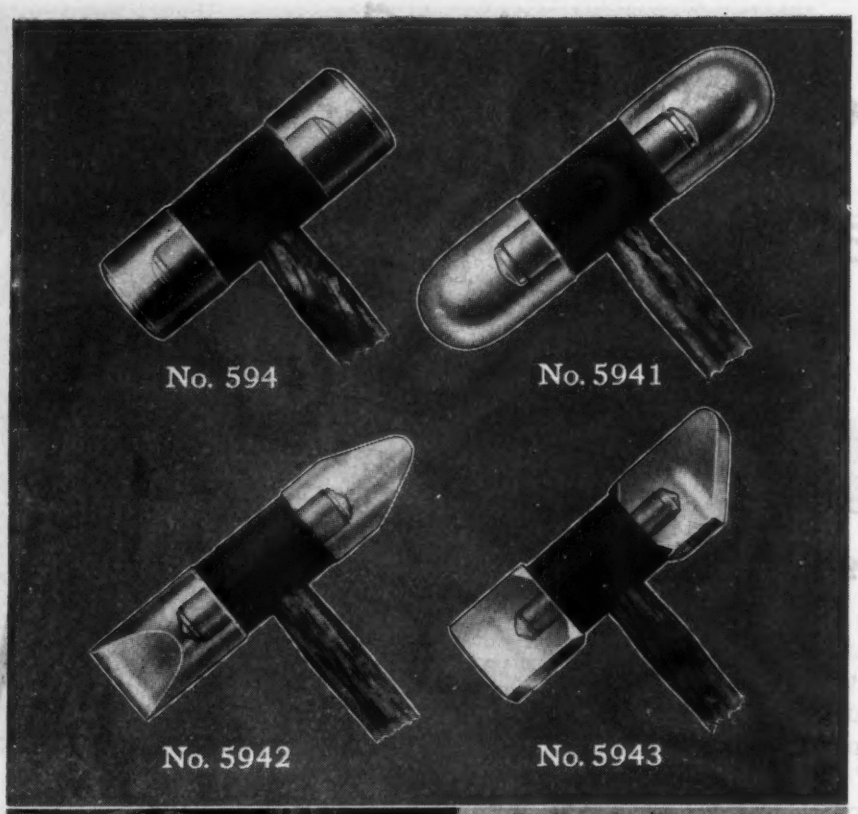
PLUMBING • HEATING • PUMPS

NATION-WIDE SERVICE THROUGH BRANCHES, WHOLESALERS, PLUMBING AND HEATING CONTRACTORS



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adaptable to stairs, ramps, floors, decks and areas around machinery, etc

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The largest volume manufacture of these devices in peacetime is still maintaining its reputation for quality products.

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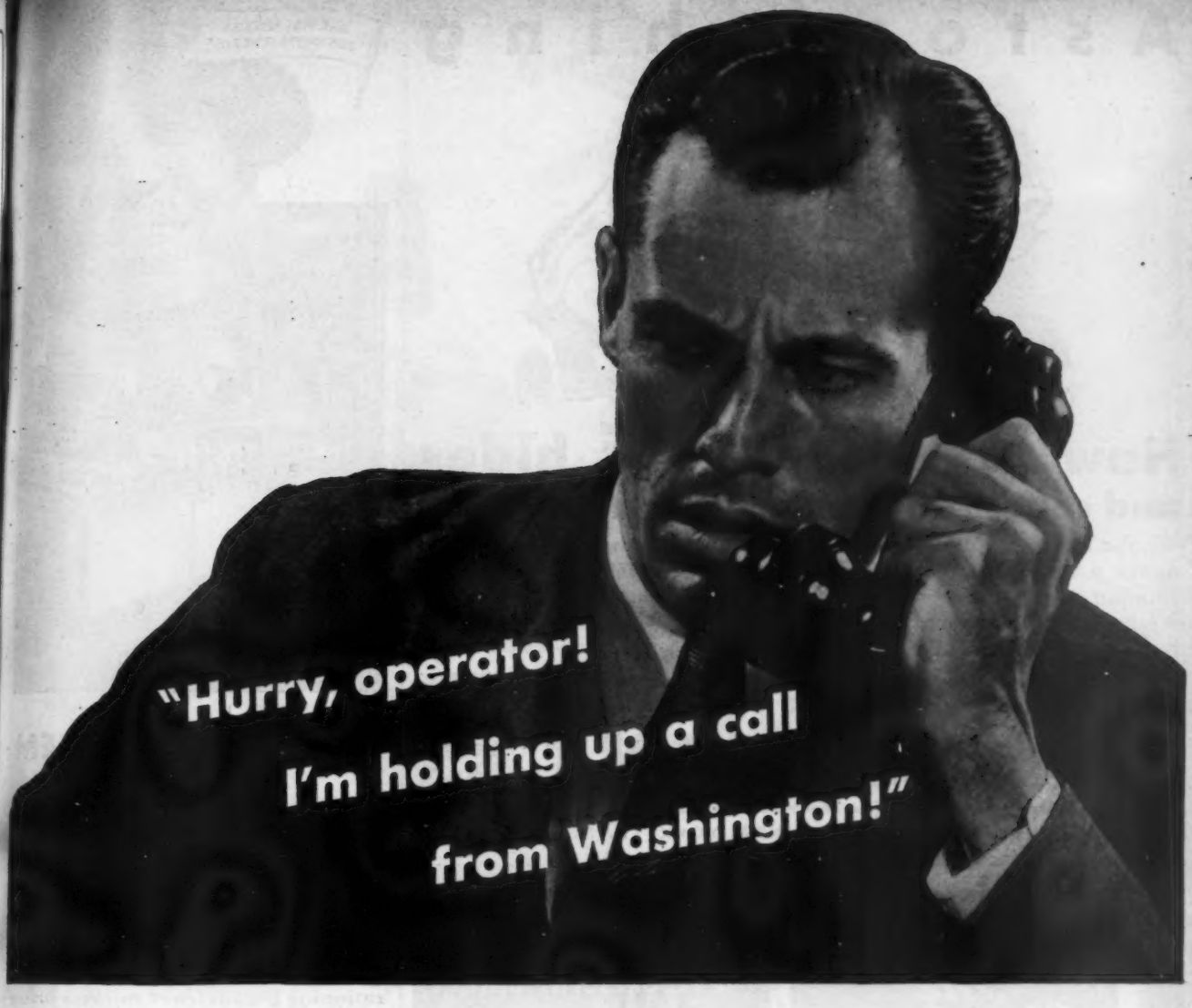

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If you're having trouble locating key people in a hurry, here's the answer to your problem: "Straight-line" communication! It will help you find your man *quicker* and *better* than any other method.

Straight-line communication helps relieve already over-crowded long distance lines . . . and it saves manpower at a time when manpower savings have never been more important.

Stromberg - Carlson communication equipment is available now on a regular priority basis. And Stromberg-Carlson engineers can show you how to get the utmost out of a system of straight-line communication — to speed production, promote safety, and boost morale.

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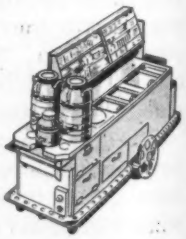
When workers STAY IN to lunch, they're back on the job sooner, feeling more refreshed, better able to *do more* the rest of the day. Since food rationing began, *fewer workers bring lunch from home* . . . so a plant cafeteria is more vital than ever to employee morale and production speed.

Pick Engineers have planned and built cafeterias for War Plants of every size and type. They know the problems . . . they can help you find the answers, whatever your budget may be. Send for our illustrated booklet No. PC 8.



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Designed to save steps, save time, save precious floor space. Keeps hot dishes, soups and coffee *piping hot* . . . serves sandwiches, drinks, pastry and candy. 4 sizes. Send for our booklet CW 6.

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A SPECIAL FRACTIONAL HP MOTOR GOES TO WORK

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The FASTER he turns . . .
the BIGGER he Gets!
40 times as BIG
In rotating parts, a tiny amount of Dy-Namic Unbalance at low speeds, becomes a great destroying force even at speeds that are only slightly higher. For instance, an ounce of Dy-Namic Unbalance at 200 RPM multiplies itself nearly 40 times at 1200 RPM.

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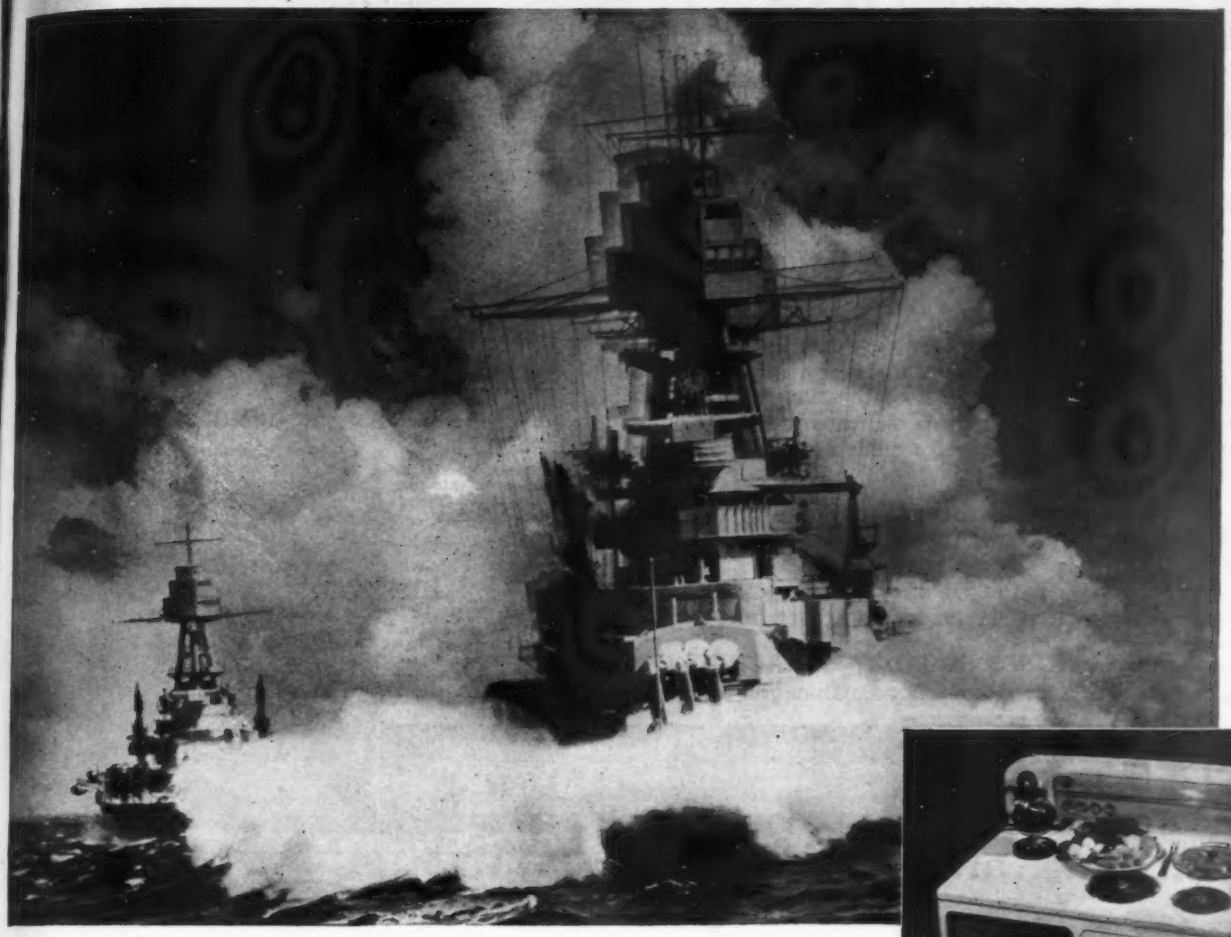
Send for new FREE Data Folder, and write us in detail about your Balancing problems so that our engineering department can make proper recommendations. Address Bear Mfg. Co., Dept. FMM Rock Island, Ill.

Making strong the things that make America strong



Holding a Ship's Shape... Shaping a Stove's Course

THAT SHIP . . . defying a rough-and-tumble fighting ocean . . . needs stiff-willed stamina in the bolts and nuts that secure its ribs.

That stove . . . built on a fast-moving production schedule . . . needs bolts and nuts that are quick on the get-away and take tightening without fumbling or jamming.

For fastening strength that will resist whatever beating a ship or steam-shovel or stone-crusher can give . . . for accurate mating that hurries a product along an assembly line: fasten with RB&W bolts and nuts.

RB&W developments in cold-forming and cold-punching have set new standards in holding power, accuracy and appearance for all kinds of fastening devices.

The dependability you would expect from the accumulated experience of 99 years and the results of hundreds of thousands of dollars' worth of research work . . . is wrapped up with every shipment of RB&W products. Little wonder that so much of the best-known farm machinery, transportation equipment, electrical appliances, construction equipment and furniture is put together faster and held together better by RB&W fasteners.

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For spotting your cars- JONES CAR PULLERS

YOU will be surprised how much time can be saved in the spotting and switching of cars by using a Jones car puller. These sturdy, compact units will speed up car handling to the point where they soon pay for themselves in the saving of time and labor.

These car pullers are built by Jones as complete units with motor included if desired, or with base to take standard motor, as supplied by the purchaser. The cable drum is driven by a Jones triple reduction Herringbone speed reducer and the control station may be located at a point to give the operator a clear view of the tracks and spotting positions.

Even in plants where comparatively few cars are handled it has been found that a Jones car puller more than pays its way. Prices and complete information will enable you to judge whether such an outfit might pay out in your plant. Write for complete information.

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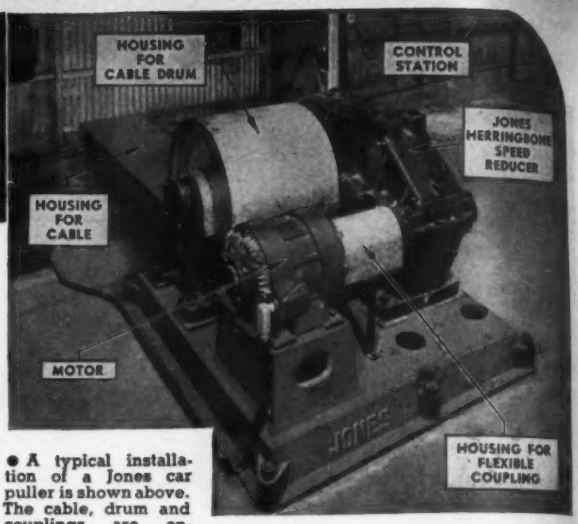

● A typical installation of a Jones car puller is shown above. The cable, drum and couplings are enclosed by sheet metal housings as an extra precaution in this installation to eliminate all hazard from moving parts.

● A complete Jones car puller unit. These outfits are for use with wire rope and are manufactured in a wide range of capacities to suit the number of cars to be handled in each plant.

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CUT AND MOLDED TOOTH GEARS • V BELT SHEAVES
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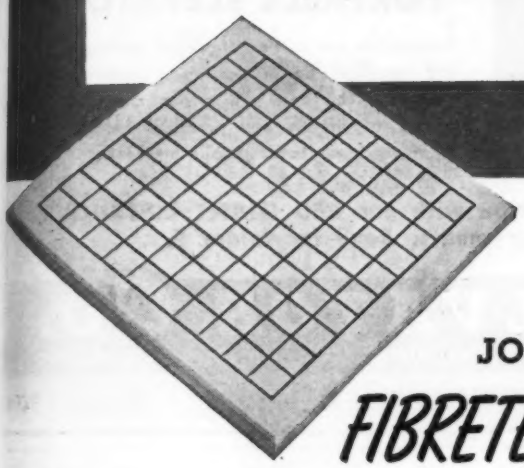
NOW READY

two new, low-cost J-M Acoustical Materials



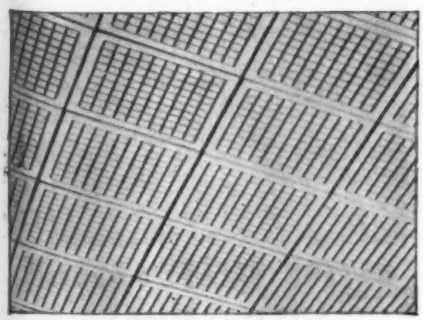
JOHNS-MANVILLE

FIBRETEX FIBRETONE

DEVELOPED by the Johns-Manville research laboratories, pioneers in the field of sound control, J-M Fibretex and Fibretone bring efficient acoustical treatment within the reach of almost any budget. They are especially recommended for quieting noise in factory offices, employees' cafeterias, corridors, and even out in the plant, too.

These two new members of the famous J-M line of acoustical materials are both made of carefully selected, clean pine fibers. This low-density wood fiber board, which also provides excellent insulation against heat and cold, is highly sound absorbent. Its smooth, durable surface which is given two coats of white paint at the factory, is not a dust-catcher. It can be painted over and over again without lessening the acoustical values. This is true because the sound absorption is accounted for principally by the deep grooves or perforations which the paint does not penetrate.

Look further into how Fibretone or Fibretex can solve your noise-quieting problem—at low cost. Send for new folder, AC-29A. Write Johns-Manville, 22 E. 40th St., New York 16, N. Y.



FIBRETEX, a grooved design, is an entirely new idea in acoustical materials, making possible new decorative effects. Highly-efficient, too.

Stand-out features of J-M FIBRETEX and FIBRETONE:

Highly efficient in quieting noise.
Low in cost, easy to maintain.
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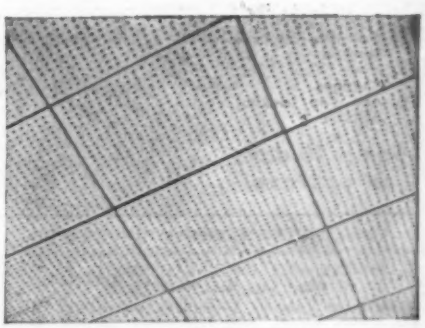
Simply, quickly installed.
Insulates against heat and cold—saves fuel.

Member of



FIBRETONE has the familiar perforated pattern, and makes an unusually attractive ceiling. Like Johns-Manville Fibretex, it comes in 12" x 12" units.

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An ABC book of timestudy

to help you get bigger output

Stressing exactly the problems the foreman encounters in making a timestudy and in applying new, improved standards, this straightforward manual shows just how to go about making the study, tells what to do in order to get the most out of the study, in bigger and better output and in improved working methods.

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By Phil Carroll, Jr.
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With a foreword by Glenn Gardiner

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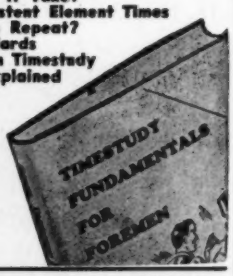
Here are the same methods used by up-and-coming modern industries—the same procedures condensed and simplified and brought by a timestudy expert to the man who wants to get more production on a down-to-earth practical scientific basis.

- The book covers the essentials with a minimum of the higher engineering aspects.
- Considerable attention is given to taking the foreman step by step through the standard-setting process by means of standard data curves, charts, and tables, in their simplest forms.
- Wage incentive plans are covered in one chapter, to show the end result of timestudy, and these are explained in terms of fundamentals and without mathematics and system names as such.

Chapters

1. What Timestudy Gives to Industry
2. Why Foremen Should Understand Timestudy
3. How to Begin a Timestudy
4. Looking at the Job Details
5. How Long Does It Take?
6. How Long Should It Take?
7. How to Set Consistent Element Times
8. What Job Details Repeat?
9. How to Set Standards
10. Be Sure to Explain Timestudy
11. Incentive Plans Explained
12. You Can Improve Methods
13. How Your Job Changes
14. Are You Looking Ahead?



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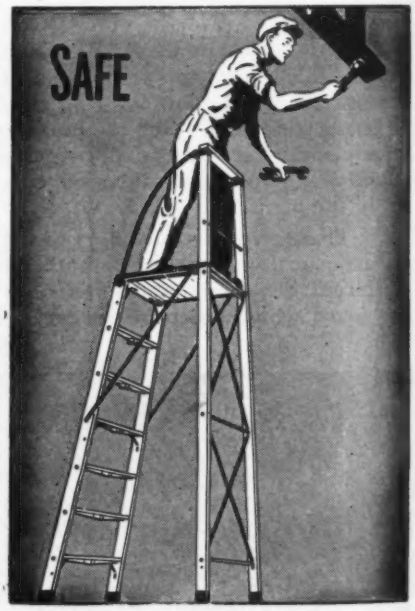

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have every advantage

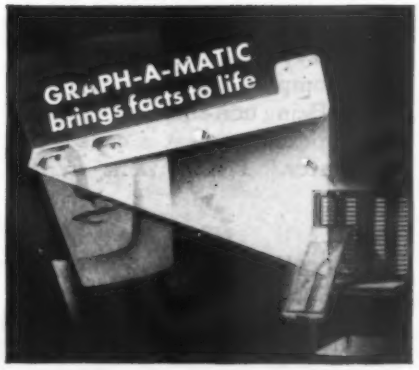
No extra man needed to steady—Roomy platform for men and tools—Great strength, lightweight—Guard rails on platform—Automatic locking—Folds compactly—Airplane spruce used throughout—Steel braces—Safety shoes. Available in sizes 3' to 16' in height—Elevating platform adds height to the Dayton Safety Ladder. *Write today for Free Catalog Prices.*

DAYTON SAFETY LADDER
122 W. 3rd St. CINCINNATI, OHIO

Now...
A BLUEPRINT
for Management!

It is already evident that the basis for satisfactory settlement of government contracts starts long in advance of termination day. The development of a standard procedure to be followed and especially maintenance of adequate records and administrative controls are demonstrated prerequisites. Not only must preparations be made to bring into proper focus complete details of work done on contracts, but the need to maintain inventories within reasonable limits consistent with program requirements is indicated.

Many other vital points were clearly brought out by the experience of the Sperry Gyroscope Co., Inc. who have used outstandingly successful methods and routines in negotiating settlement. Through the courtesy of Sperry officials we are able to offer you a most helpful brochure, just prepared, covering this entire subject and showing how Sperry's records serve as a "blueprint" for working out speedy and satisfactory settlements. This timely and valuable brochure is offered as a free service, for it entails no obligation.



TEAR OFF AND MAIL

Remington Rand, Systems Division, Buffalo 3, N. Y.
Send me a personal copy and ..... additional copies (for other executives of my company) of the brochure "Effective Control of Terminated Government Contracts".

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SYSTEMS DIVISION
REMINGTON RAND
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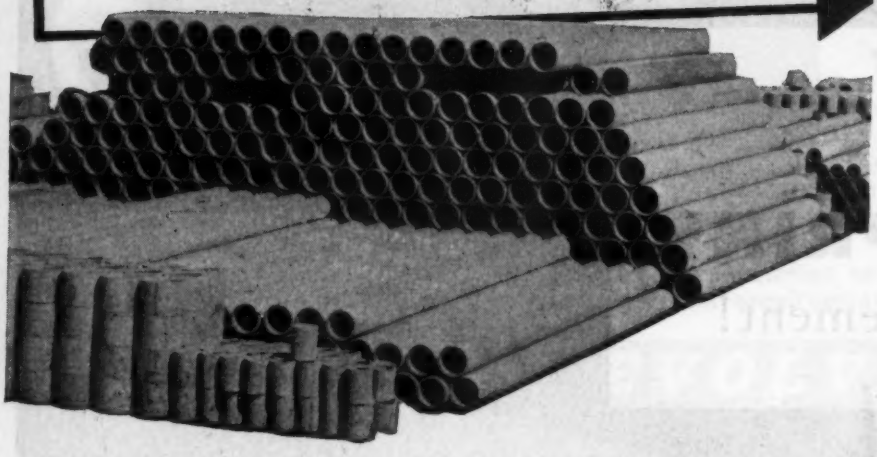
NOW READY
FOR PROMPT DELIVERY
TRANSITE PIPE!



HERE'S good news from our factories: Johns-Manville Transite Pipe, the asbestos-cement pipe so ideally suited for all types of water lines, may again be obtained promptly.

Being non-metallic, Transite Pipe cannot rust or cause "red water." It maintains an unusually high delivery capacity because its smooth interior stays smooth in service. Simple assembly plus the advantages of long, light-weight lengths make Transite Pipe easy to handle and install. For complete information write Johns-Manville, 22 East 40th Street, New York 16, N.Y.

USE TRANSITE PIPE FOR:
Supply Lines
Fire Lines
Condenser Water Lines
Process Lines of many types
Also Transite Sewer Pipe for various types of industrial sewerage systems

ENGINEERING DATA on Transite Pipe
SIZES: 3" to 36"
Class 50-50 lbs. per sq. in.
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For underground and overhead systems, couplings of various types to meet requirements.
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JM PRODUCTS
JOHNS-MANVILLE
TRANSITE PIPE
AN ASBESTOS PRODUCT
For Efficient, Economical Industrial Water Lines

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KEYSTONE Industrial Visual Safety Tests (IVS) play an important role in America's vital war industry.

The employe's visual efficiency, depth perception, vertical and lateral balance, fusion, sharpness of image and color blindness are quickly and efficiently recorded. With this data, he can be assigned work for which he is visually fitted.

Write today for complete bulletin.

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★ Steel production capacity will continue to be a war need — — — UNTIL VICTORY.

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Get in the Scrap Today!

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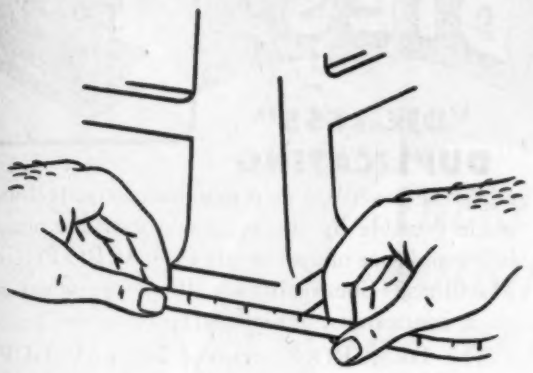
On Your Marks . . . Get Set



1. Send Felters a brief description and weight of the machine, measurements of the base or feet Felters will mail you Unisorb pads of the proper density and size—exact fits for your marks.

2. Cover both sides of the Unisorb Felt Pads with Eagle Brand Cement

MOVE IT

with Felters Unisorb

NO BOLTS - NO SEAMS - NO DAMAGE TO FLOORS

Just follow the simple directions under the illustrations for the easy, time-and-money-saving Felters way to relocate one machine or a dozen. With the Unisorb method of machine relocation, no holes need to be located and drilled, no bolts and hold-downs supplied and tightened.

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"DIE-LESS" DUPLICATING

might be described as a new industrial technique made possible by the accuracy, extreme adaptability and ease of operation of DI-ACRO Precision Machines—Shears, Brakes, Benders—when used as a continuous, integrated production process.

The DI-ACRO System of METAL DUPLICATING WITHOUT DIES has proven its adaptability in making parts just as accurately as can be done with dies, to a tolerance of .001" in all duplicated work. The delay of waiting for dies is avoided, deliveries speeded up.

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by BACON

"America's Oldest Felt Manufacturers"

ESTABLISHED 1824

Felt Does it Better

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The manufacture of felt wheels is a craft with little use being made of mass production equipment. Human skill and human hands are still the controlling factors. That's why the phrase "oldest felt manufacturers in America" takes on a real meaning for those who buy and use felt wheels.

Bacon PARAMOUNT BRAND Felt Wheels are of the highest quality it is possible to make. They give full measure of service for the dollar invested.

We make felt wheels in 9 different degrees of hardness and in a wide range of diameters and thicknesses.

Try PARAMOUNT BRAND next time.

BACON FELT COMPANY

WINCHESTER, MASS.

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Do people like you *instinctively?*

$1.75

Do you know how easy it is to exercise the qualities that impress people favorably, that lead them instinctively to give that extra ounce of loyalty, cooperation, and effort to your ideas and orders?

To win the rewards that beckon to leadership today, in all walks of life, you *must work with people*—get them to like you—get over your ideas to them—influence their thoughts and actions. And now a plain method of developing this ability—11 simple rules that successful business leaders follow—things that *you can start doing today, without study or practice*—are given in this new book.

THE TECHNIQUE OF HANDLING PEOPLE

By DONALD A. LAIRD and ELEANOR C. LAIRD

Read what—

EUGENE G. GRACE, who became president of Bethlehem Steel at thirty-seven, says about observation;

WALTER A. GIFFORD, who became president of A. T. & T. at forty, says about listening to opinions;

CHARLES E. WILSON, self-made president of General Electric, says about wanting to get ahead;

WALTER D. FULLER, who advanced from selling copies of the *Saturday Evening Post* to presidency of the Curtis Publishing Co., says about Big Ideas to get ahead;

LOUIS RUTHENBURG, who became president of Servel at forty-six, says about the spirit of work.

The observations of these and many other important men of industry lend concrete evidence to back up the soundness of Dr. Laird's book. The book gives seasoned, practical advice on the technique of handling people and shows in quickly understandable fashion how to use the psychology of leadership.

How to understand and work with others

This readable, practical manual presents 11 pointers on what to do and say in your everyday contacts with others, in order to win their friendship, good-will, and cooperation. The methods are clearly demonstrated in numerous stories of real people, outstanding leaders, of today, and together form a direct, easy-to-understand, easy-to-use technique for improving your relations with others and especially for securing better results in training, directing, supervising, and other elements of successful leadership.

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Send me Laird's The Technique of Handling People for 10 days' examination on approval. In 10 days I will send $1.75, plus few cents postage, or return book postpaid. (Postage paid on cash orders.)

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Position .....

Company .....Fac. 3-44

(Books sent on approval in U. S. and Canada only)

Why not be sure about your roof?

Have it surveyed by experts . . . at no cost to you

JUST BECAUSE that roof on your factory has never given you trouble before does not mean it is in A-1 shape. Trouble might be brewing. Flashings may be torn or cracked. Roofing felts may be drying out. Decks may be starting to rot away. Roof trouble starts small but builds up fast.

Johns-Manville offers you an easy way to get the facts about your roof . . . now . . . facts that may save you costly repairs later on. Without cost or obligation to you, a survey will be made by an expert J-M approved roofing contractor, which will tell you the exact condition of your roof. It will include not only the main roof area, but also the flashings, parapets, skylight walls, ventilators, and other vital parts of your roof, too.

This survey will also give you a permanent record of your roof for reference so that you may plan ahead for any maintenance work which may be needed in the future. Look further into the ounce-of-prevention J-M Roof Survey Plan—today!

Ask for this free Roofing Book

Based on over 86 years' experience with roofing problems of all kinds, Johns-Manville has published an interesting booklet entitled "Things You Should Know About Your Roof."

This booklet discusses all the critical areas and is liberally illustrated with many easily understood diagrams. It includes a complete description of J-M Asbestos Built-Up Roofs which are well known for their fireproof, rot-proof and lasting qualities. For a free copy, mail the coupon.

JOHNS-MANVILLE JM PRODUCTS

JOHNS-MANVILLE—Desk "F"
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Gentlemen:

Please mail me a free copy of your book, "Things You Should Know About Your Roof."

( ) *Check here for further information about the J-M Roof Survey Plan.*

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Built-Up Roofs

Brevity is the Soul of Wit—

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Conserving Paper

SURE IT'S EASIER to let your dictation roll along. Sure it's easier to write long copy. Sure it's easier to do all the good, pleasant things of normal peacetime business when paper is like water, something you can pretty well use as you will.

But now, when the increasing paper needs of the armed services daily decrease the national supply of paper—when paper is a true war essential—that's a different story.

All of us in business must watch every piece of paper or paper board we use. We must judge its use in terms of absolute necessity. We must not use a single piece, a single inch, of paper which thriftier writing or printing or packaging can possibly save.

For multiplied on a national scale, that particular piece or inch of paper or paper board becomes the tonnage needed by our service forces to ship precious food and ammunition and weapons and medical supplies and blood plasma to our troops overseas.

If there's no Paper Conservation Committee in your organization or in your community, why not get one going today?

This advertisement prepared under the auspices of the War Advertising Council in co-operation with the Office of War Information and the War Production Board.

USE LESS PAPER BECAUSE

It takes 25 tons of blueprint paper to make a battleship.

700,000 different kind of items are shipped to the Army—and they're paper-wrapped or boxed.

"K" ration containers, shipped from the Eastern Seaboard alone, take 662 pounds of paper a month.

Each Signal Corps radio set takes 7 pounds of kraft paper, 3 pounds of book paper.

Each propelling charge for 155-millimeter shell takes 3/5 pound of paper.

USE LESS PAPER THESE WAYS

Review all printed forms periodically for essentiality; consolidation; elimination of waste space; standardization of sizes, weights, color, grade; elimination of color where possible.

Eliminate slack fills, thus effecting the economies of a smaller package.

Use 8½x5½-inch letterheads for short letters; inclose them in small envelopes.

Adjust the number of units per case to the maximum practical.

Use and re-use carbon paper consistently.

Conversely, reduce the number of units to utilize lighter carton board when such reduction will result in less tonnage over-all. Be sure that the openings are on the smallest dimension of the shipping container, so that the flaps will have the smallest area possible.

LET'S ALL USE LESS PAPER

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American

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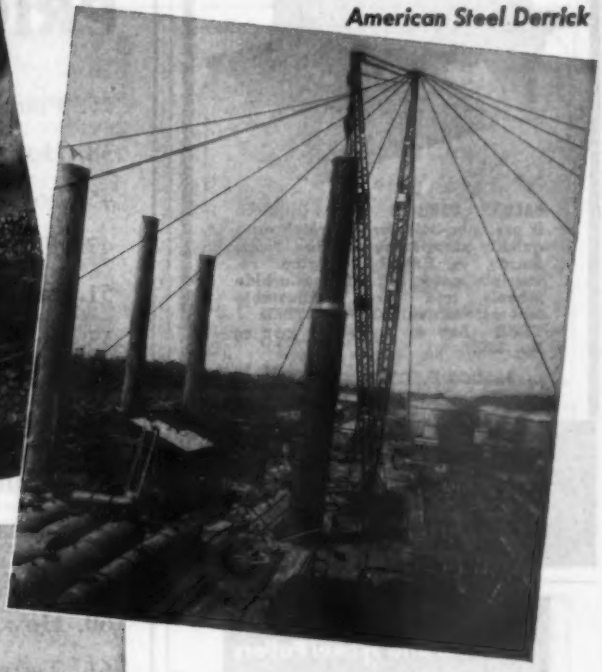
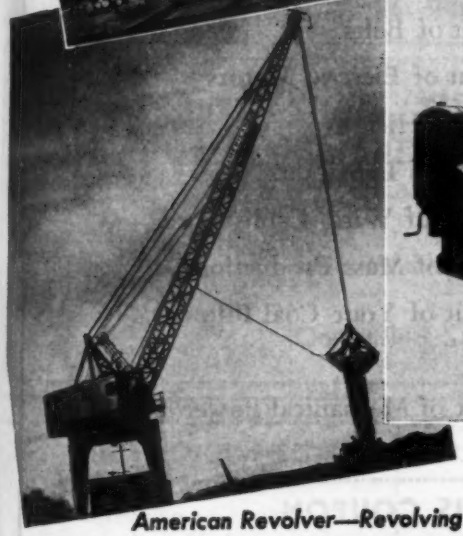
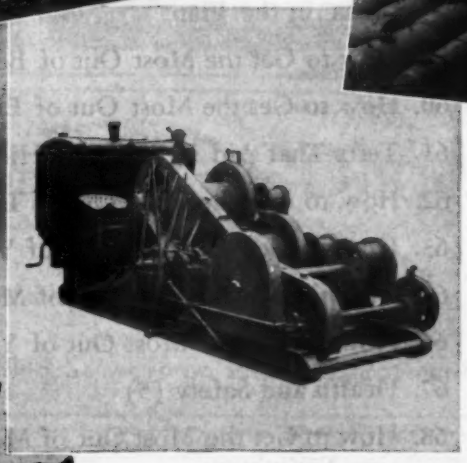
American Locomotive Crane

American Steel Derrick





American Revolver—Revolving Crane



American All Purpose Hoist

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AMERICAN HOIST & DERRICK CO.

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***for Quickly and Accurately sharpening* CARBIDE TOOLS**

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POWERS TEMPERATURE and HUMIDITY CONTROL
For Industrial Processes, Heating and Air Conditioning Systems, Hot Water Heaters and Shower Baths. Write for Bulletins.
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Ask For CATALOG
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Graduate mechanical engineers in inorganic chemical production. Some production experience preferable. Give complete details of training and experience, and enclose small, recent photo.

Applications will be held confidential and answered.

P-700, Factory Mgt. & Maintenance
330 W. 42nd St., New York 18, N. Y.

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INDUSTRIAL ENGINEER — Old established company now reconverting to pre-war production (essential products) has opening for graduate industrial or mechanical engineer who is interested in following time study, motion time analysis, job evaluation, and general industrial engineering work as a profession. Experience desirable but not essential. If employed in war industry, statement of availability required. Give complete details of personal qualifications and work history in letter of application to P-665, Factory Management & Maintenance, 330 W. 42nd St., New York 18, N. Y.

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(Additional Positions Vacant Advertisements on opposite page)

POSITIONS WANTED

INDUSTRIAL ENGINEER qualified to act as Plant Manager, Assistant Plant Manager, Chief Industrial Engineer — 22 years experience job evaluation, methods improvement, cost control, budgets, standards, factory layout, incentives, foreman training, industrial relations, supervision. Protestant. Employed. PW-658, Factory Management & Maintenance, 68 Post Street, San Francisco 4, Cal.

INDUSTRIAL ENGINEER — Married—3B—14 years experience installing and administrating Wage Incentive plans. Individual and group. 12 years with large chemical company. Experience includes equipment, design, methods, time-study, wage incentives. Now Time-Study Supervisor. Desires executive or supervisory position with reputable large company engaged in War work which normally has basic peace time business. Minimum salary $7000-$7500. PW-669, Factory Management & Maintenance, 520 N. Michigan Ave., Chicago 11, Ill.

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PLANT MANAGER: Engineering graduate, now superintendent and with 15 years industrial engineering background seeking to manage plant employing 500 to 1000 whose war-time and port-war plans require smooth introduction of practical production and cost controls. Experienced from both line and staff end in incentive wage payment, cost reduction, budgetary control of expenses, product planning, coordination and control of development of new products. PW-686, Factory Management & Maintenance, 330 W. 42nd St., New York 18, N. Y.

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We want two men with broad experience in industrial engineering to work on post-war planning problems in manufacturing. These men should be well grounded in costs, methods, layout work and organization from a manufacturing standpoint. Must be willing to move if opportunity offers. Present location, Massachusetts.

If you feel your experience fits you for one of these opportunities, write immediately, giving education, experience, age and salary desired to start. All replies strictly confidential.

P-698, Factory Management and Maintenance
330 West 42nd St., New York 18, N. Y.

POSITIONS WANTED

ENGINEER—qualified to act as Plant Engineer, Plant Manager, or Assistant to President on engineering management assignments. Thirty years diversified industrial organization experience—design, construction, rehabilitation, layout, operation, supervision. A producer—results based upon accomplishments. Fifty years of age, registered professional engineer. Correspondence invited. PW-706, Factory Management & Maintenance, 330 W. 42nd St., New York 18, N. Y.

EXECUTIVE WORKS MANAGER SUPERINTENDENT age 42, employed, desires change for personal reasons. Experiencd operating plant and supervision over 2500 people including operating, laboratory, engineering, planning, costs, production, personnel, etc., manufacturing, processing, and assembly. Proven record of results, assume responsibility, sound judgment, and effective control. Foreign service considered. Replies confidential and answered. PW-704, Factory Management & Maintenance, 330 W. 42nd St., New York 18, N. Y.

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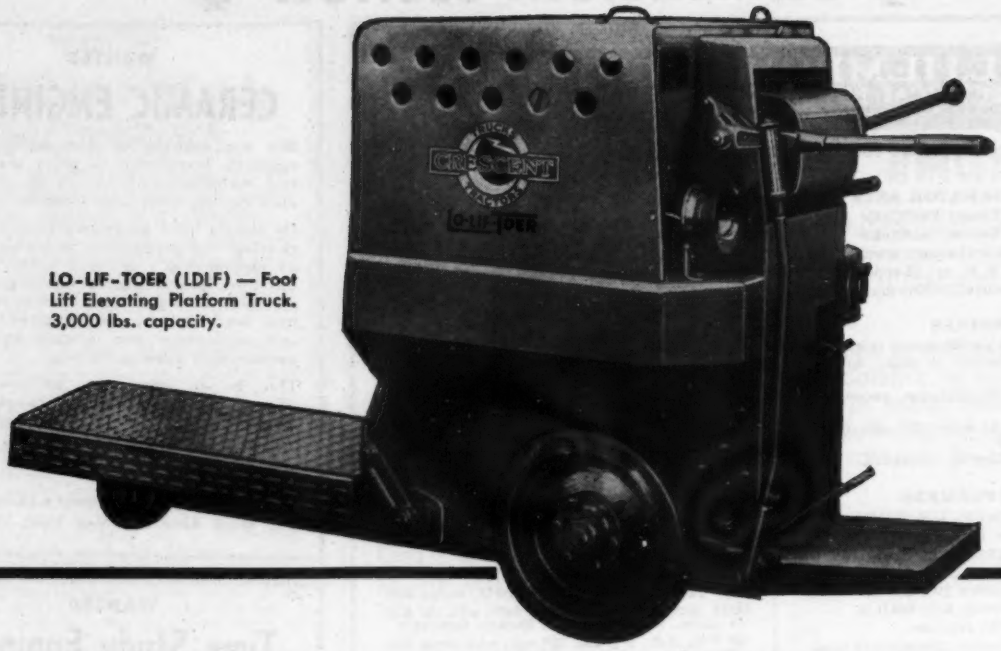

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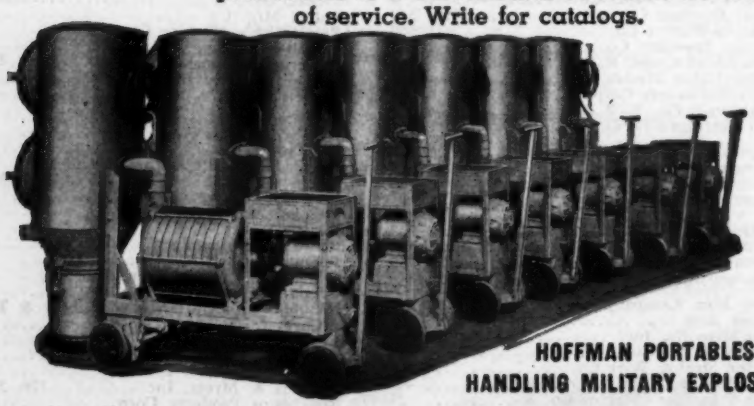

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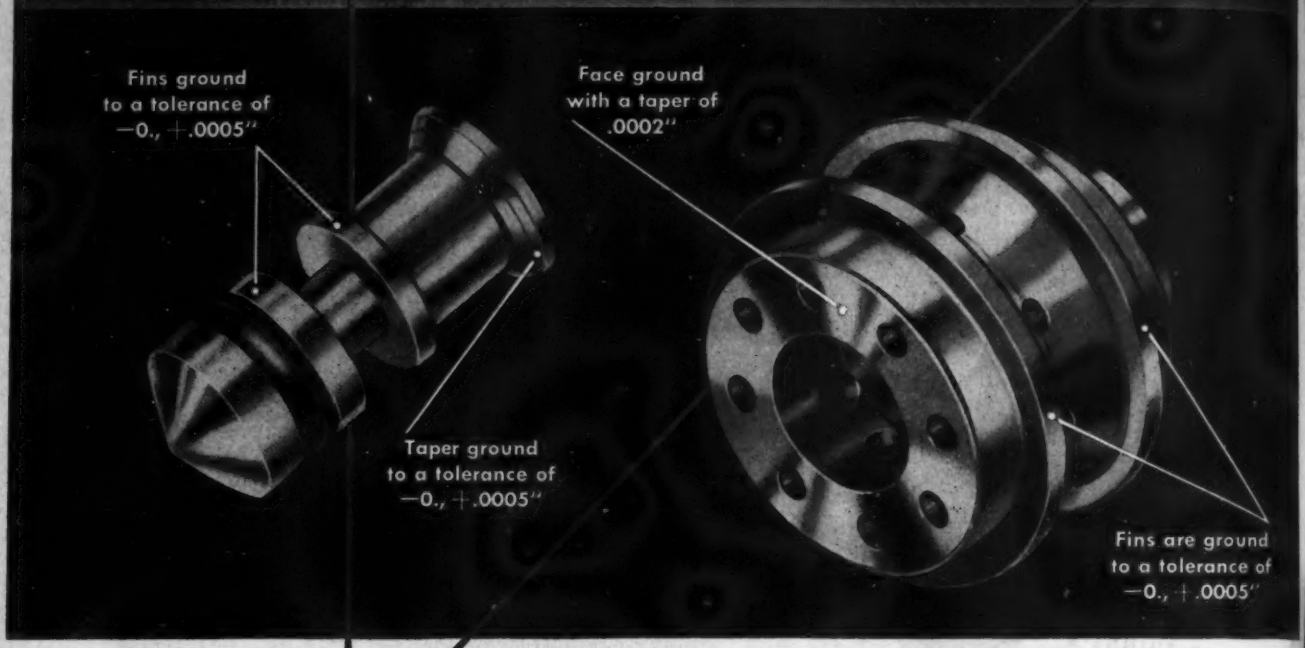
BUILT IN A RANGE OF 18 SIZES — 4½ TONS CAPACITY AND LARGER

Let's get acquainted
INVESTIGATE THIS Different CRAWLER CRANE

NORTHWEST

The Crane that goes Anywhere!

8 SHOPS TRIED TO GRIND THESE PARTS . . . ONLY *One* LICKED THE JOB!


Fins ground to a tolerance of —0., +.0005"
Face ground with a taper of .0002"
Taper ground to a tolerance of —0., +.0005"
Fins are ground to a tolerance of —0., +.0005"

INGENUITY PLUS THE "DUMORE SYSTEM" WINS AGAIN!

Once more the combination of a Dumore Precision Grinder and a standard machine tool supplied the answer to a tough problem. (See part tolerances in illustrations.) "Seven other shops attempted this job, including some equipped with heavy costly machinery. Ours was the only one that licked it!" So says the Superintendent of the shop, where the "Dumore System" is producing 600 of these units in a 9-hour day on a battery of 4 machines.

If you have precision grinding to do, in production volume or in tool room operations, investigate the "Dumore System." Write for the details of Dumore's practical and economical precision today. The Dumore Company, Tool Division, Dept. TC28, Racine, Wis.

Get the latest data on Thread Grinding in this new Bulletin. Send for copy, Now!

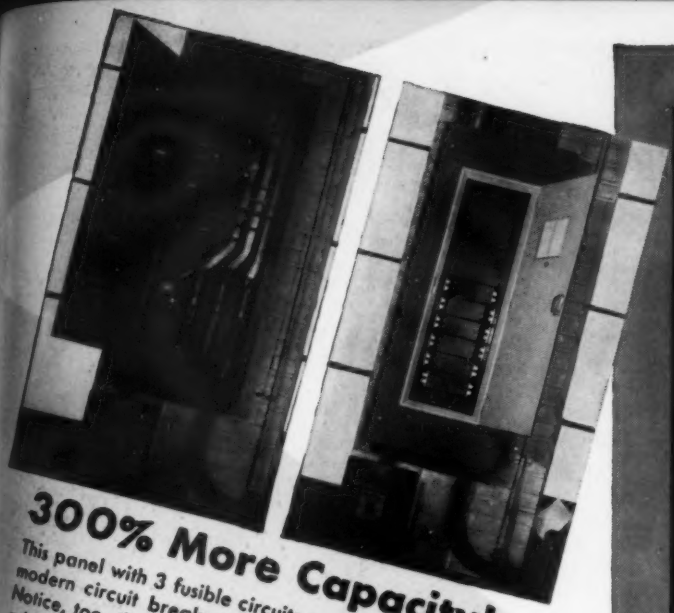
DUMORE

PRECISION AND OFF-HAND GRINDERS

DUMORE GRINDERS ARE SOLD ONLY BY AUTHORIZED INDUSTRIAL DISTRIBUTORS IN ALL PRINCIPAL CITIES

more capacity

THROUGH THIS SPEEDY *Square D* CONVERSION PLAN

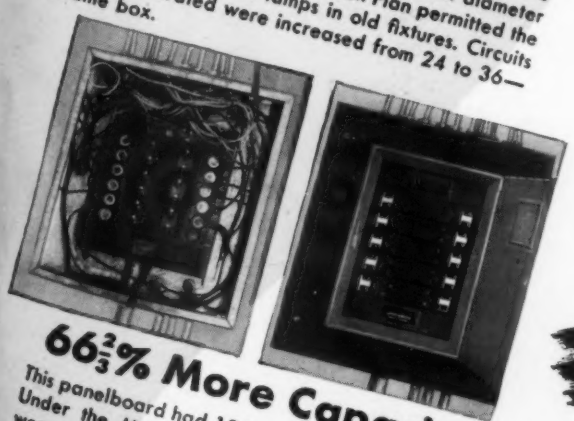


300% More Capacity!

This panel with 3 fusible circuits was converted to a modern circuit breaker installation with 12 circuits. Notice, too, that provision has been made for an additional 8 circuits whenever they are needed.

50% More Capacity!

300 watt lamps were being used. Panelboards were running hot and voltage drop was heavy. Small diameter wire and the multi-breaker Conversion Plan permitted the use of 500 and 750 watt lamps in old fixtures. Circuits in the panel illustrated were increased from 24 to 36—in the same box.



66⅔% More Capacity!

This panelboard had 12 lighting and power circuits. Under the Multi-breaker Conversion Plan, circuits were increased to 20 without removing the existing box or adding conduit.

Here are three typical examples of conversions which involved a minimum of installation time and labor and brought the following results:

- Increased panelboard capacities and added modern circuit breaker convenience and protection.
- Utilized existing boxes and conduit.
- Conserved power previously lost through over-loads.
- Eliminated the replacement of branch circuit switches and fuse clips due to excessive heating.

CALL IN A SQUARE D FIELD ENGINEER

Increasing the efficiency of your electrical distribution system will help to meet today's manpower shortages and will pay big dividends in the highly competitive and narrow-margin days ahead. A Square D Field Engineer will be glad to work with you on any conversion problem

ELECTRICAL EQUIPMENT • KOLLSMAN AIRCRAFT INSTRUMENTS

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DETROIT • MILWAUKEE • LOS ANGELES

ONE LOOK . . . and no questions asked!

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WHEN buying factory equipment of any kind equipped with tapered roller bearings, insist on seeing a sample of the bearing used, and look for the trade-mark "TIMKEN" stamped on both *cup* and *cone.* If you see it you'll know exactly what you're getting.

When selling factory equipment containing Timken Tapered Roller Bearings, point out this trade-mark to the prospective buyer. Your selling time and cost—as far as the bearings are concerned—will end right there. One look—and no questions asked; such questions as: "Who makes them?" "Are they correctly designed?" "Are they made of good steel?" "Has the bearing manufacturer had specialized experience in applying them to this kind of equipment?"

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